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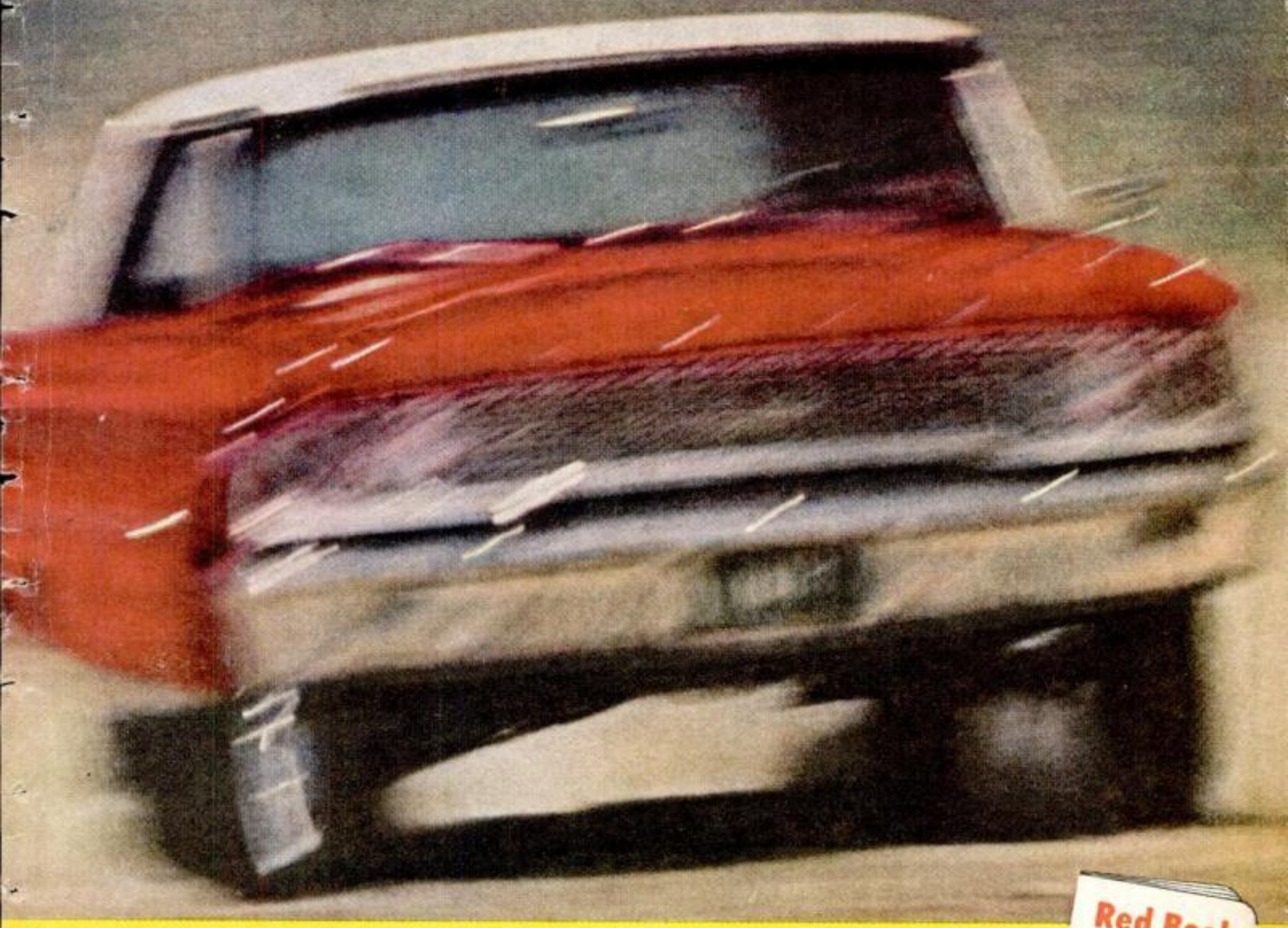
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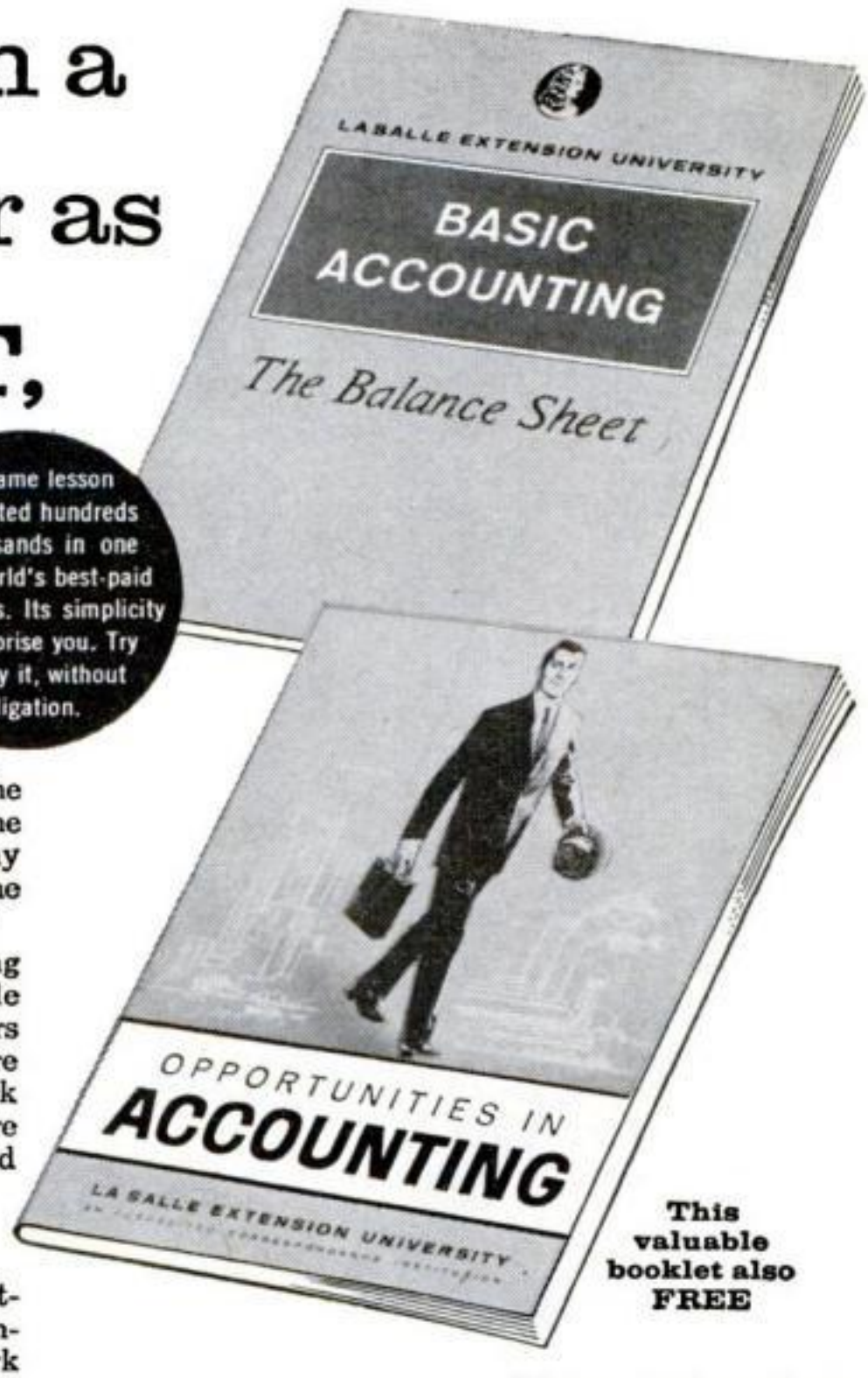
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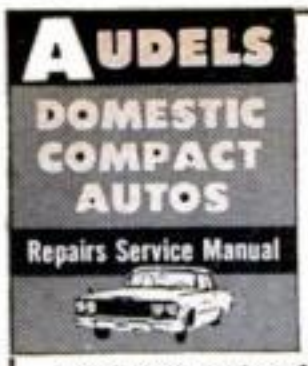
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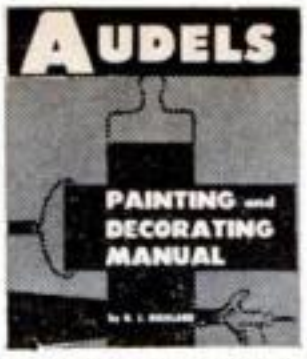
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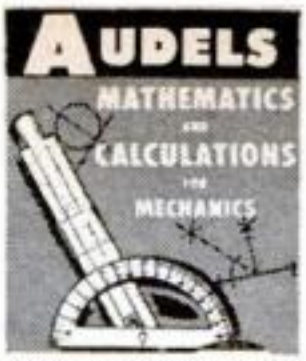
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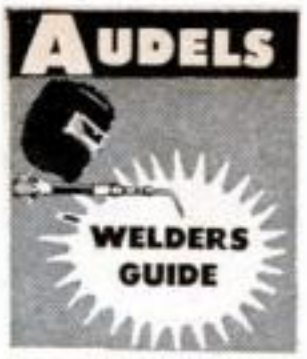
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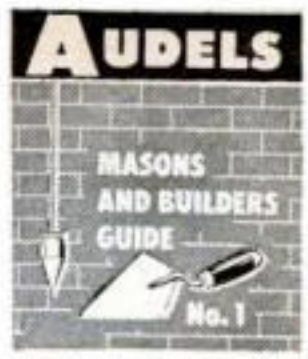
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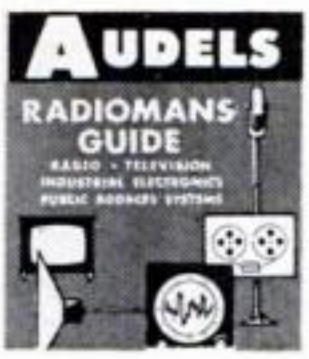
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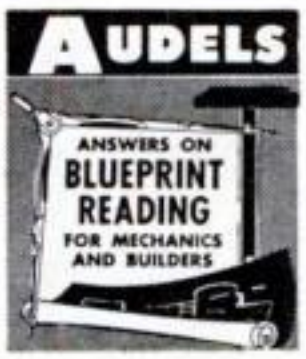
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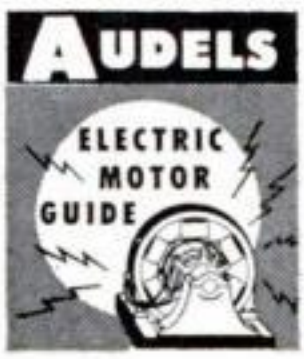
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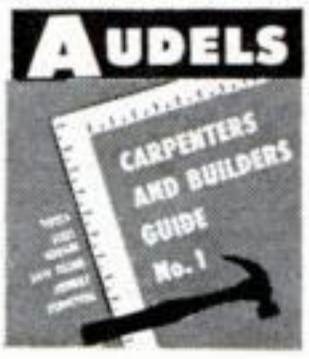
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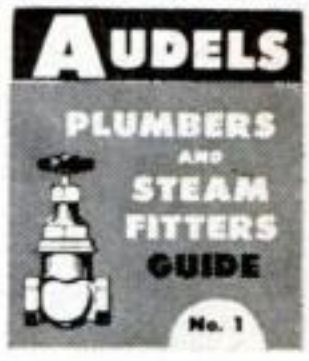
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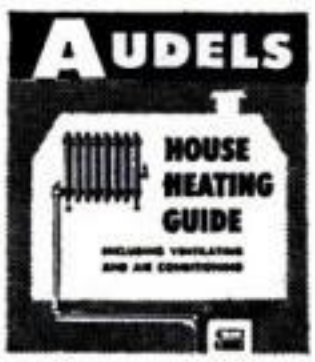
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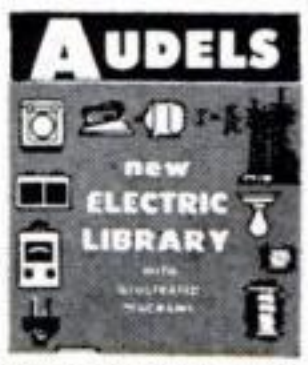
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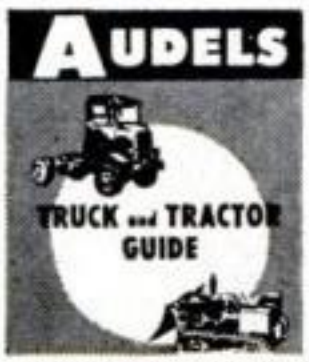
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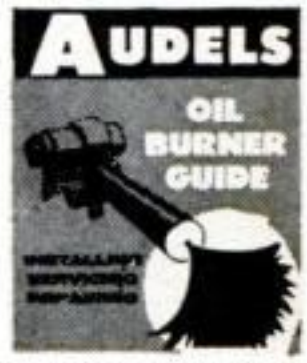
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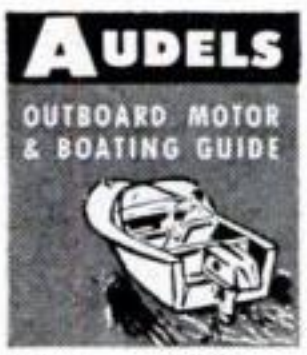
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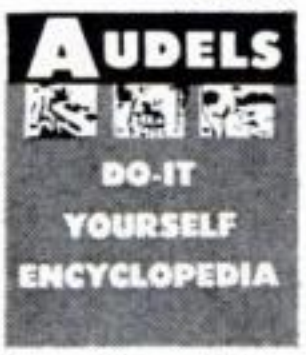
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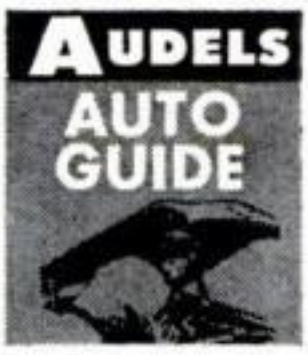
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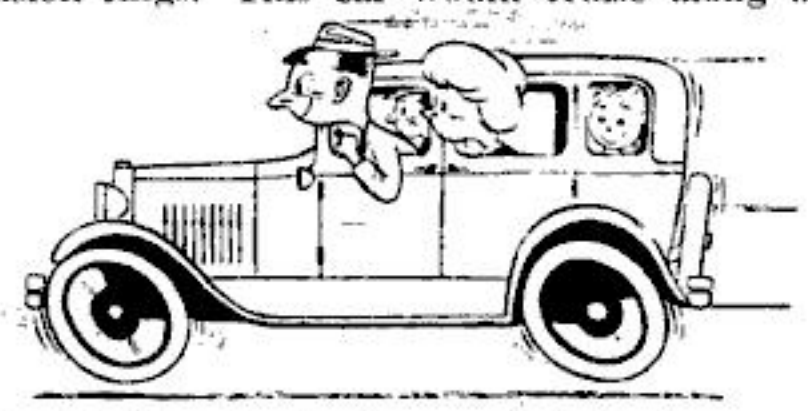
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PS readers talk back

Word from the Old Car Buffs

I read with interest Ford Motor's plans to develop a true 100,000-mile car ["Detroit Report," June]. I owned seven or eight Model A's, the last one a 1931 sedan with model B head, which gave a little more soup, and high tension rings. This car would cruise along at



65 with four passengers and their baggage, giving a cool 20-22 m.p.g. Maintenance was nil—a set of points occasionally or a set of spark plugs.

Ford could have guaranteed the Model A for 100,000 miles without fear.

DARL G. WHITNEY, Butte, Mont.

Half Bigger Than the Whole!

On the cars for the Indy 500 this year ["Can Detroit Move In on Indy?" May]: When Jack Brabham drove the Cooper in 1961, he did *not* have a V-8 in it. It used a 2.7-liter Coventry-Climax 4-cylinder engine—a slightly enlarged version of their "standard" 2.5-liter Grand Prix engine. Admittedly, the design of the engine started in the early fifties as a 4 OHC V-8 of 2.5 liters. They cut it in half to get a DOHC straight 4 of 1.5 liters for Formula II racing, then enlarged this 4 gradually to the full 2.5 liters for Formula I, and even to 2.7 for Brabham's Indy car and a few other Formula Libra and Sports cars—but none of the V-8s have been raced as far as I know. This must be one of the few cases where half an engine winds up bigger than the whole!

D. M. WELLS, Chestnut Hill, Mass.

Going into the Drink

Your readers might be interested to know the method used in Holland "If Your Car Goes into the Water," [June]. In that flat country with its many dikes, this type of accident is a common occurrence and all are taught what to do.

Since unequal pressure causes the doors to jam, windows are opened several inches to let the car fill with water. The air pocket

CONTINUED

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I found the Easy Way to escape from being a "Wage Slave"



I kept my job while my customer list grew ... then found myself in a high-profit business.

Five years ago I wouldn't have believed that I could be where I am today. I have a business of my own that provides my family with the standards of living I want them to have. My four children will now be able to go to college. I have two service men working for me and I look forward to the day when I will do no service work myself but will concentrate on filling out orders. And, it's all due to the fact that I filled out a coupon from a Duraclean advertisement.

Five years ago I was deeply in debt and my confidence had been badly shaken by a disastrous business set-back. All I had was my dream of a bigger income and the independence and security of my own business. Then I saw the Duraclean advertisement and said to myself, "Maybe this is it."

It was. I applied for the service dealership in my locality and got it. Becoming a Duraclean dealer was so much easier than I thought because I found that if a man is honest, reliable and willing to work, the Duraclean company will help finance him. I started part time but as soon as my spare time earnings would support my family, I quit my job and gave full time to my new business.

The knowledge that I had a world-wide organization behind me restored my confidence and made me feel I was really moving toward success. One of the greatest things I learned was that my customers were my best salesmen because the service I offered was genuinely superior to other methods.

My principal service is a safer and greatly improved method for cleaning carpets and upholstery right in the customer's home. My customers are thrilled at the personal care given their furnishings. There is no mechanical scrubbing, or soaking; no harsh solvents or soaps. Instead of driving dirt and grime deeper into the pile, it is gently removed *by absorption*. The Duraclean method doesn't merely clean . . . it enlivens the fibers and brightens the colors and, so little moisture is used that carpets and furniture are dry and ready for use in a few hours.

The Duraclean process I use is so superior that it is endorsed by leading furniture and carpet manufacturers, and backed by Parents Magazine Seal and McCalls "Use Tested" approval. As I found early in my career, these famous endorsements make orders come easy.

In addition to cleaning I have five other services to offer—services that are needed and wanted and provide an extra income from established cleaning customers.

My first year as a Duraclean dealer was good. I was independent. I had no bosses, no monotonous office or plant routine, no job uncertainty, no layoffs. I began to pay off my debts and felt a real feeling of security. Then bad luck struck again.

First my wife broke her leg. Then she injured her back and was hospitalized for five weeks. Then a dog bite sent me to the hospital for five weeks and I was confined to bed for another two months. Doctor and hospital bills piled up.

But once again my Duraclean business stood by me. As soon as I was on my feet, my income began to build up again. I began to whittle down my new load of debts. My customers didn't forget me—thanks to the excellence of the Duraclean service—and with the help I got from the Duraclean organization, orders continued to flow in.

The Duraclean company is like one big family and I know I am a part of it. They do everything they can to get business for me—including pre-tested ads, store displays, even a mailing program. The latest aid is a seven minute full color film to show in a customer's home or office. They place national advertising in House & Garden, House Beautiful, McCalls and Parents magazines and other fine home magazines. Inquiries from my locality resulting from these ads are immediately sent to me. In addition we have regional meetings where we can exchange ideas with other owners of Duraclean Businesses.

My Duraclean business has increased so wonderfully that I have now opened a shop for prestige—though my wife still takes orders over the telephone at home. I feel that I have finally "arrived" and I look forward to the future with hope, confidence and satisfaction. After so many years of struggle and hard luck Duraclean has provided my family with comparative luxury. I am grateful for this opportunity to tell my experiences to others who might be looking for a happier and more fruitful life. I find it hard to believe that all this came from my mailing a coupon from a Duraclean ad.

Tony Nobrega

Information is Free—Just Send Name

Yes, Tony Nobrega mailed a coupon just like the one below. This could be an opportunity for you, too. The locality near your home might still be available for your Duraclean Business. Mail the coupon below today. We'll mail you all the facts including a 24 page book with no obligation. No salesman will call on you. Decide for yourself whether you want to enjoy the same improvement in your life that Tony Nobrega found.

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PS readers talk back continued

formed allows breathing. When the water rises sufficiently, the door itself is opened. In this way an uninjured person can save another not able to escape through a window.

LILLIAN SEIGEL, New Hampton, N. Y.

. . . Just as your article appeared, our daily paper reported that four cars had plunged off a washed-out bridge at Murdochville in Quebec. One car, a Volkswagen, was washed ashore by the racing water. The little car hit the water, went under, and floated up again. The four occupants got out the door and swam a dozen yards to land. The VW floated on 200 yards until it brushed the shore. So far, the other cars have not been recovered and the occupants have not been found.

RON B. GORRIE, Timmins, Ont., Can.

The Call of the Road

I read your special section in May ["Vacations on Wheels"] with interest as we have our own unique camper—a family bus. We purchased a 1955 Superior-bodied, 78-passenger bus. It's powered by a Ford 317-cu. in. industrial engine.

My dad and I removed all but a few of the seats and installed a couch, cabinets, sink with



running water, shower, toilet, clothes closet, and beds to sleep eight. We built the rig for less than $3,500. We save enough on motels over our month's vacation to pay for the gas.

MIKE FORD, Abilene, Tex.

Stuck Valve Retainers

I learned 25 years ago that it's bad practice to use a piece of pipe and a hammer to "pop off" valve retainers ["Hints from the Model Garage," May]. Have Gus try this himself: Check the tension of a new valve spring on a good tester. Install it in the regular manner on the head. Remove the spring with a piece of pipe and a hammer. Recheck the tension. He'll find he's knocked a lot of life out of the spring.

E. L. GEIPER, Pittsburgh.

Fads and Fancies

In "Science and Supermen" [May], you say "more than 100 men today could beat Johnny Weismuller's record, using fast flip turns he

CONTINUED

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PS readers talk back continued

never thought of." The flip turn is a mere fad and not as fast as the flat turn. Johnny was very fast at both starting and turning and surely would beat any man swimming today at either.

The reason free-style and backstroke swimming records are going down is that we have freed ourselves of the idea that the crawl kick gives propulsion. The legs kick only to keep them from sinking. I learned this when I observed that a good swimmer's hand came out of the water at the same place he put it in. If the legs were pushing, the hand would appear beyond where it went in. Progression comes from the arms, and about 90 percent from the hand alone. Nor does the dolphin kick in the butterfly supply push. The frog kick in the breast stroke does push, but swimmers are learning to use a faster and narrower kick.

Coaches were responsible for holding back progress. In practically all sports they hold many false ideas.

K. R. BOWERS, Louisville, Ky.

If There's Corn on the Menu . . .

Last summer, some bright soul came up with a hot idea for a butter dispenser ["I'd Like to See Them Make," Aug. '62] to apply same to corn on the cob. This year, not finding it ever got to market, I tried a little experiment:

I took an old stick-deodorant dispenser (Old Spice), sterilized it, painted it, forced a stick of butter into the tube, and stored it in the refrig until it hardened. Works fine. Butter can be pushed to the surface like the former contents. Dinner guests thought it quite novel. My thanks to you, and the original "inventor," for our handy utensil.

RALPH HOWARD, Potsdam, N.Y.

Anybody for Aquakarting?

I am still getting letters from your readers asking for plans for building the Aquakart



[Mar. '62]. Since there's such widespread interest in the water kart, you might like to mention that the address given in the article is now incorrect. We have left the wide-open spaces of Texas for 7465 Park Towne South, St. Louis 20, Mo.

JOHN ROGERS, St. Louis.

The plans for the Aquakart are $5.

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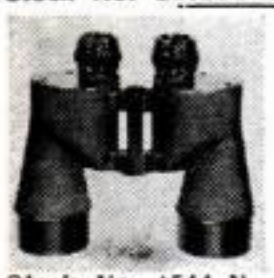
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Science newsfront

BY WALLACE CLOUD

A monthly report: What's going on in science and why it's important to you

WEAPONS

For economy: the F-Bomb

Behind recent cloak-and-dagger exposures in Switzerland appears to be the development of a new type of atomic weapon by West German scientists working for the government of Egypt.

Israeli agents have been implicated in the disappearance and attempted assassination of German experts on rockets and "nonconventional weapons."

The United Arab Republic has test-fired and publicly displayed military rockets, but Cairo doesn't have the resources to develop atomic explosives. Instead, Egypt is believed to be working on a simplified atomic warhead: a canister of radioactive cobalt and strontium, to be scattered over a target by conventional high explosives.

Such a "fallout bomb" wouldn't produce the blast effects of an A-bomb, but would kill, disable, and poison its victims through radiation sickness and contamination of food and water. The materials required are relatively cheap and available. About 500 German scientists and technicians in Egypt are reported to be working on rockets and planes to deliver the bomb.

CHEMISTRY

Krypton's crown topples

Another of the "noble gases," krypton, can no longer be considered chemically aloof. Chemists at Temple University have succeeded in making krypton tetrafluoride.

Generations of chemistry teachers have propagated the belief that krypton (along with helium, neon, xenon, argon, and radon) is unable to combine with other elements. The idea was overthrown last fall when researchers at Argonne National Laboratory made xenon and radon fluorides. Since then a number of laboratories have investigated the properties of these compounds and others made from them, particularly xenon oxides.

As you might guess, the compounds, which usually occur as small crystals, are highly unstable, tending to decompose explosively. That they form at all is a result of the extreme chemical aggressiveness of fluorine. Preparation of the fluorides is fairly simple: The "inert" gas is mixed with fluorine gas and the mixture, in a closed container, is heated or subjected to an electric discharge.

So what's new about these discoveries? POPULAR SCIENCE Senior Editor A. P. Armagnac dredged up an old item from PS (February, 1936) that tells how Prof. Harold S. Booth of Western Reserve University made argon compounds by reacting argon with boron trifluoride.

SPACE

What to breathe in space?

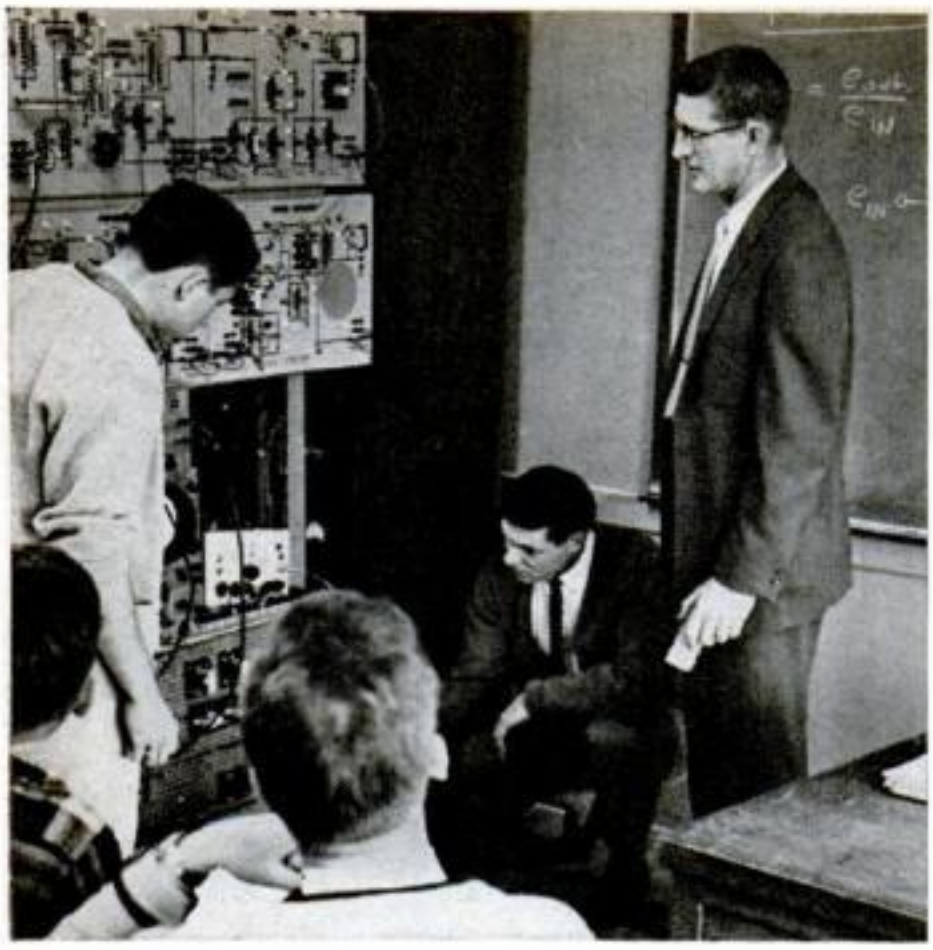
There's more than one way to get killed in space. Some unexpected hazards were revealed when 200 medical men, at a recent Aerospace Medical Association meeting, ex-

CONTINUED



How to burn a hole in a frying pan is demonstrated by Westinghouse engineer L. S. Frost, a developer of "the world's hottest light beam." The device uses an elliptical mirror inside a sealed chamber to focus the heat and light from a plasma jet hotter than the sun's surface. It's used for burning holes in frying pans—and also for testing the effects of re-entry heating on models of spacecraft.

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*Source: Survey by Engineering Manpower Commission of Engineers Joint Council

pressed overwhelming opposition to the planned use of a breathing atmosphere of 100-percent oxygen in the Gemini and Apollo space flights.

Oxygen only, at five pounds per square inch, has been used without adverse effects in the Mercury program, as an outgrowth of the system used for many years by high-altitude aviators. But the Mercury flights were of short duration. Space-cabin simulation of longer space flights, conducted by Republic Aviation for NASA, turned up a number of serious problems.

What to breathe underwater. Living at the pressure-equivalent of 100 feet under the sea, three U.S. Navy chief petty officers recently spent eight days in a pressure chamber, breathing a mixture of helium and oxygen. That's the breathing mixture being used by Ed Link in a series of long, deep dives [see "The Race for the Bottom of the Sea," PS, July]. Although it was a simulated dive on dry land, the Navy experiment represents the *longest* dive to date, but not the *deepest* dive of long duration. One of Link's divers, Robert Stenuit, spent three days and 23 hours at 200 feet in the Mediterranean Sea last summer.

Two-thirds of the subjects, who lived in low-pressure pure oxygen for two weeks, developed anemia. Many also showed impaired vision, which could lead to fatal errors of judgment in carrying out docking maneuvers in space. After this study, NASA decided not to pay for a follow-up study that would have assessed long-term effects on the volunteers.

Fire is another hazard of the 100-percent-oxygen atmosphere. Materials burn six times faster and ignite at lower temperatures than in air.

One fire broke out when a man attempted to remove a burned-out light bulb with a towel. In another incident, a subject tried to slap out a fire with his hand, only to have the hand burst into flames. Fires can't be smothered in pure oxygen, since porous substances and also human skin become dangerously "soaked" with oxygen molecules.

NASA defends its choice of pure oxygen on the ground that it simplifies engineering. Use of air or another mixed-gas system would require additional tanks and valves,

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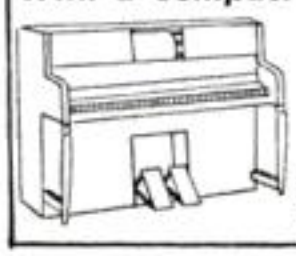
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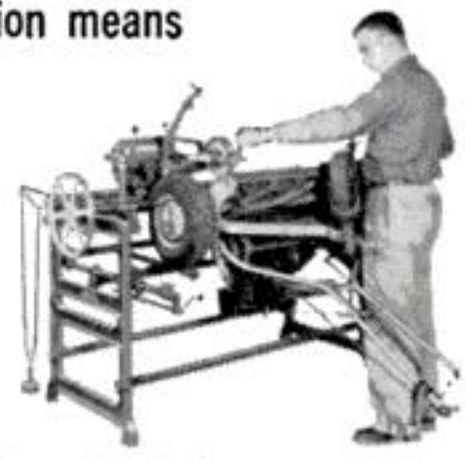
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Science newsfront continued

and would increase the weight of the spacecraft. Pressure would have to be higher to deliver the same quantity of oxygen to the astronauts, so the problem of leakage would be greater. There would be complications, including danger of the bends, in switching to pure oxygen at lower pressure in a space suit—necessary to maintain flexibility of the suit.

Evidently this is one situation in which the space engineers will have to use more ingenuity to cope with the limitations of their perishable human cargo.

ASTRONOMY

Hi, neighbor

Still no definite evidence of intelligent beings out there in space, but the first planet-size planet in another solar system has been found. About 1½ times as big as Jupiter, it revolves around Barnard's Star, six light-years (or 36 trillion miles) away from the earth.

Dr. Peter van de Kamp of Sproul Observatory at Swarthmore College discovered the planet, which can't be seen, by measuring how Barnard's Star wobbles due to the gravitational attraction of its companion. Astronomers at Sproul Observatory have detected two other planetary systems, one in 1943 and the other in 1960, but in those cases the attracting masses are so large that they represent small, dark stars rather than planets.

ELECTRONICS

Beaming electric power

The old dream of transmitting electric power by radio may soon become a reality, according to two Purdue engineering professors. Drs. R. H. George and E. M. Sabbagh claim to have converted 70 percent of the power delivered by a 2.5-megacycle microwave beam into usable direct current. Using conventional solid-state diode rectifiers, their experimental apparatus produced only 40 watts, but it's the percentage of efficiency that counts. So far, the high efficiency is a result of new circuits the two men have developed, and they say efficiencies over 90 percent, plus increased power, will be possible when better semiconductor diodes are developed. ■ ■

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Dr. von Braun, left, addresses national space conference in Chicago. With him is David M. Kennedy, chairman, Committee for Economic and Cultural Development of Chicago.

Dr. Wernher von Braun takes a look at

MARS

Are its canals full of water? Is there really life there?

Timetable to planet Mars

Solving Mars' mysteries with space probes—as foreseen here by Dr. von Braun—could come as soon as this year or next.

The first U.S. attempt is planned for the next favorable launch date, which will come about November, 1964. After that, the best time would be about December, 1966.

A Soviet Mars probe was launched at the last favorable date, in late 1962, but failed in its mission—radio contact was lost before it passed Mars last June. Now the Russians announce they'll try again in 1963. If they do, instead of awaiting a favorable date to conserve power and permit maximum payload, the launch will be an innovation in planetary shots.—The Editors.

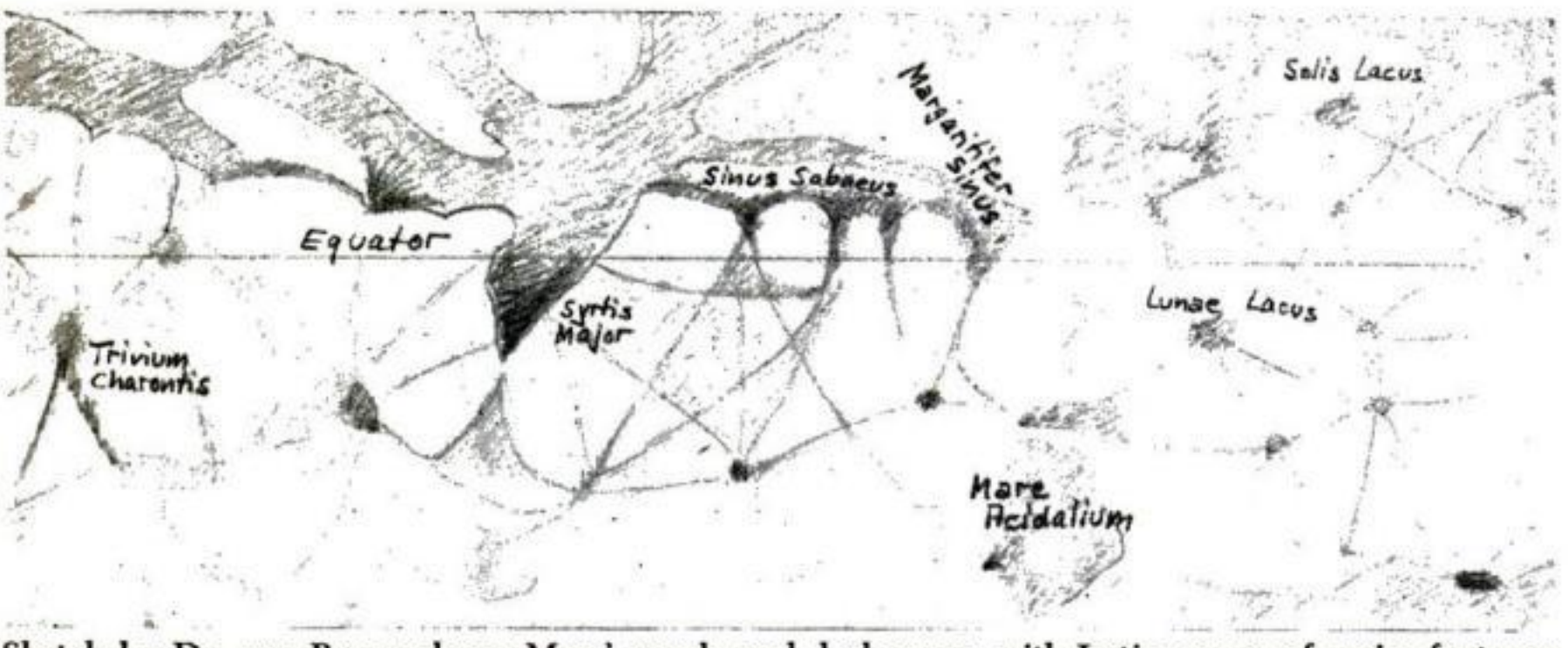
Q ***What are the canals of Mars?***

A When Mars was in a particularly favorable position for observation in 1877, the Italian astronomer Giovanni Schiaparelli announced the discovery of a network of very narrow and perfectly straight lines, which seemed to crisscross the surface of Mars like a spider web. For want of a better word he called these lines "canali."

As other astronomers got into the act to verify (or refute) Schiaparelli's canals, a whole set of criteria for these mysterious lines emerged in the professional literature:

- Most canals, observers reported, followed great circles of the planet's sphere.
- First observed only in the bright ("desert") regions of Mars, the canals were found to cross some dark areas, too.
- In areas covered overnight by "snow" (now believed to be hoarfrost), a canal was still clearly discernible, although its width was greatly reduced.
- All canals began and ended in dark regions, or in dark spots called "oases"; none was ever seen to disappear in a bright "desert" region.
- The canals' visibility was clearly linked to the seasons on Mars. As the white northern polar cap receded during the Martian spring, canals of the northern hemisphere

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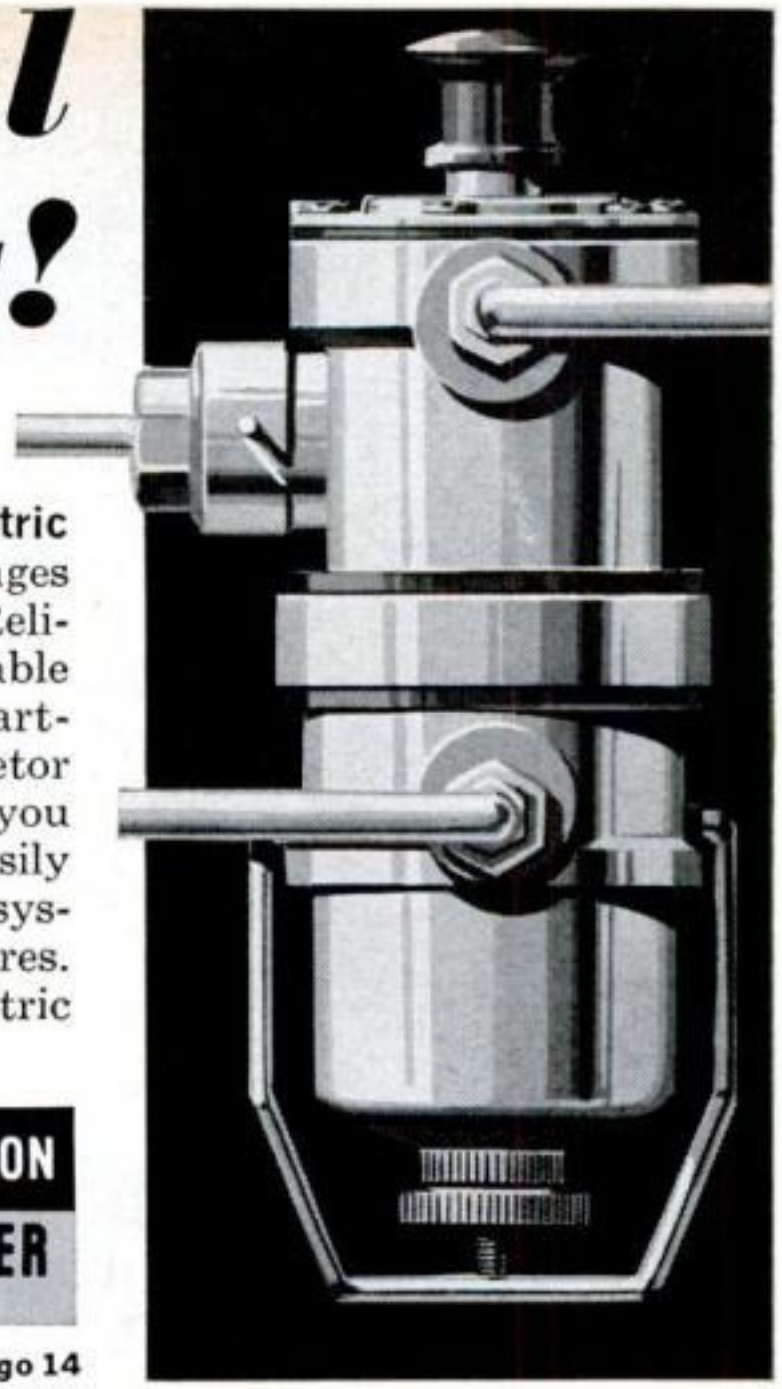


Sketch by Dr. von Braun shows Mars' canals and dark areas, with Latin names of major features.

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Dr. Wernher von Braun continued

increased in strength and contrast. Half a Martian year later, the same phenomenon took place in the southern hemisphere.

● During periods of seasonal strength, a strong canal would suddenly appear doubled. Where there had been a single great-circle line the night before, there would now be two parallel lines.

Did Martians dig the canals?

All these exciting observations inevitably led to speculation that the Martian canals might be the handiwork of highly intelligent beings. The flagbearer of this proposal was the American astronomer Percival Lowell, one of the most outstanding planetary observers of all times. Mars was a dry planet, his reasoning went—well over half its surface was arid desert. Its main supply of water was available when its supposedly snow-covered polar caps melted during northern or southern springtime.

What would be more logical, therefore, than for Martians to develop a system of irrigation canals—to carry water from the melting polar snow caps to warmer latitudes, where food crops could be grown only if the ground were watered? To Lowell and his school, what they saw of a canal was not the water-carrying ditch itself—it would have had to be hundreds of miles wide to be seen with telescopes available then—but the bands of vegetation on both sides, like the green banks along the Nile or Rio Grande. Lowell's intriguing idea found worldwide support.

But, with the advent of more-advanced telescopes, it was finally shot to pieces. Using these more-powerful instruments, observers could clearly see much fine detail that had eluded the smaller telescopes of Schiaparelli and Lowell. Now a canal, instead of being a straight thin line, took on the appearance of a succession of irregular details.

Moreover, our present knowledge of Martian atmospheric pressure and surface temperatures precludes the possibility of open water.

We now know with a high degree of certainty that the small amount of water available on Mars is carried through the atmosphere in the form of ice crystals. Winds deposit this ice as hoarfrost in the

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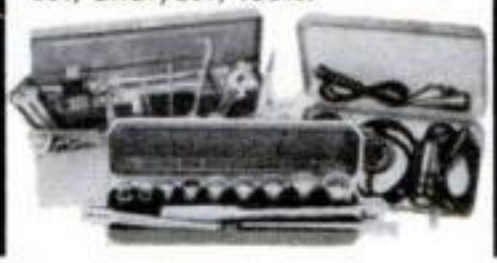
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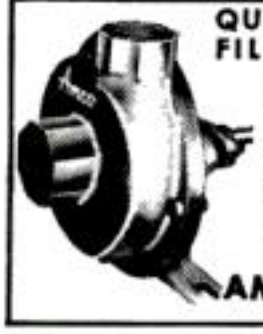
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Dr. Wernher von Braun continued

polar regions during the winter months of the respective hemispheres. At winter's end the hoarfrost layer forming a polar cap has an estimated thickness of only a fraction of an inch.

However, the most up-to-date observations fully confirm the existence of predominant directions along which "activities" on the face of Mars are oriented. A canal is now looked upon as an axis along which is clustered a great deal of detail. Seasonal variations of the contrast with which this detail may be observed have likewise been fully verified.

Further, after many decades of carefully recorded observations of Mars, it has become quite evident that some previously reported areas of conspicuous detail and contrast have now become quite faint. Conversely, some formerly faint areas have become much stronger. And some areas, such as the Nepenthes-Thoth region, alternate between phases of great intensity and faintness.

Summing up, we can only say that the canals of Mars remain a riddle. Unlike the moon, which is a dead world, the surface of Mars shows seasonal as well as long-term changes. It is an immense challenge for future astronauts.

Q ***Can we expect to find life on Mars?***

A Astronomers are extremely reluctant to answer this question with a flat "yes" or "no." The available evidence really is still too tenuous. In the past, researchers were often carried away by their enthusiasm and strong convictions. Now, in this age of planetary rocket probes, they are painfully aware that they can no longer make pronouncements—which may be refuted tomorrow by overwhelming new evidence—with impunity.

The question of life on Mars centers about the planet's dark areas, whose contours change with the seasons. To explain why they do, three hypotheses have been advanced. Two are "non-vegetative," while the third ascribes the changes to some unknown type of vegetation.

First let us look at the so-called *volcanic* hypothesis. It proposes that suitably located volcanoes produce vast quantities of ash and

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cinders, more or less continuously. These are carried away by the winds prevailing at the season, and are deposited in certain stable and repeatable patterns. The trouble with this theory is that it calls for volcanoes different from any we know on earth, where none erupt steadily. Also, spectrographic studies of the Martian atmosphere fail to indicate the existence of large quantities of suspended dust.

The *mineral-coloration* hypothesis, the second non-vegetative one, assumes a seasonal variation in the color of certain minerals that make up the dark areas. It is known that many "hygroscopic" or water-absorbing substances change in color, according to how much water they soak up. As the prevailing winds carry Mars' scarce water supply in seasonal cycles between the northern and southern hemispheres, the theory goes, the changing humidity of the atmosphere alters the coloration of the material covering the surface of the dark areas.

This hypothesis has several moot points. On Mars, water does not rain out and "soak" the surface—but is deposited in the form of ice crystals, as hoarfrost. And no known salts or minerals are noticeably changed in color by the minute quantities of water involved, even making the unlikely assumption that all the hoarfrost melted and was soaked up by underlying material. Finally, this hypothesis cannot explain the striking phenomenon of the dark areas' "regeneration":

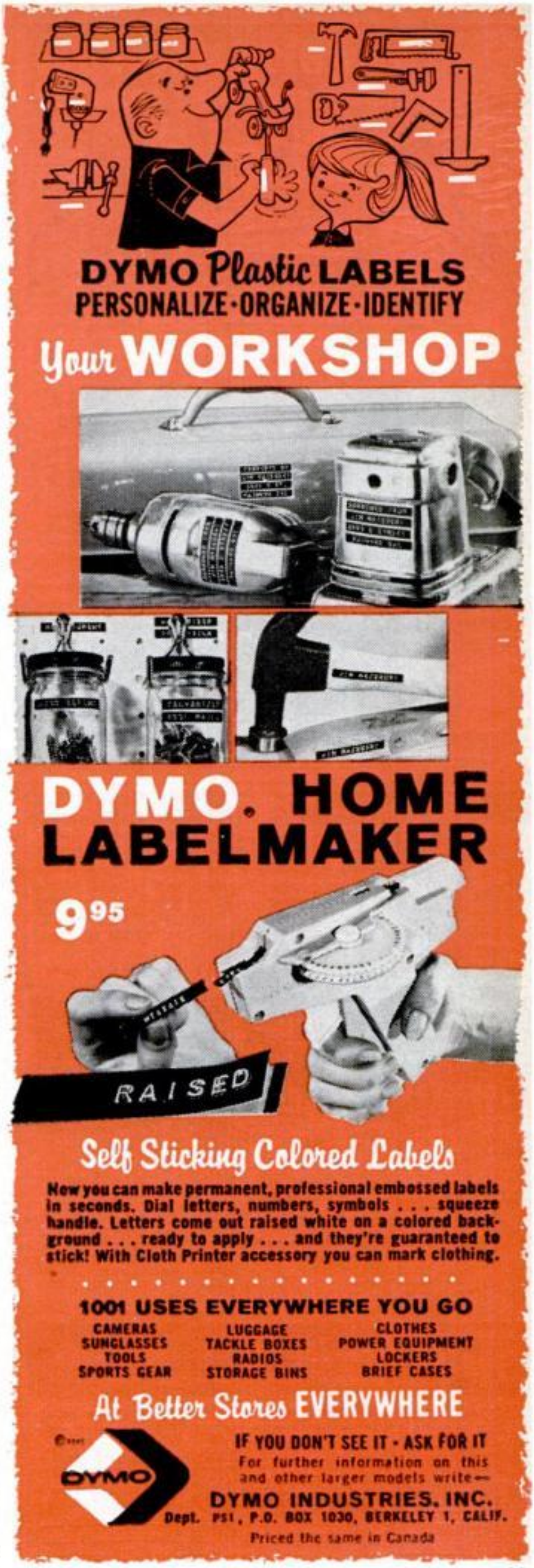
Dust storms often are observed to deposit, on portions of dark areas, layers of the yellowish material that prevails in adjacent bright areas. But within a few weeks the dark area invariably regains its former contours!

Without some regenerative power (such as vegetative processes), it seems that any dark area would be buried miles deep under the yellow dust, after millions of years of dust storms.

Changing markings a sign of life?

Finally there is the *vegetative* hypothesis —the one that assumes the existence of life on Mars. The dark areas, it suggests, are covered by some form of vegetation that withers during the fall. It snaps back in the spring when the temperature rises, and

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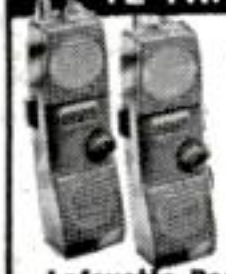
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Dr. Wernher von Braun continued

the seasonal winds carry the humidity from the evaporating polar cap to lower latitudes.

The weakest point of the vegetative hypothesis is Mars' inhospitable climate. The French astronomer Gerard de Vaucouleurs, probably the greatest living expert on Mars, once described it this way: "Take a desert on earth, shift it to the polar regions, and lift it to stratosphere level—that's what it is like on Mars." And there seems to be little or no oxygen (no more than 0.15 percent, by the best estimates) in the Martian atmosphere, which consists almost wholly of nitrogen.

Can life, as we know it, exist under such conditions?

Many biologists believe that certain low forms of earthly life such as lichens, microscopic algae, and bacteria would indeed survive if transplanted to Mars.

Or perhaps—life as we *don't* know it?

But must life on Mars be limited to these lowest forms? Look at the tremendous variety of forms of life on earth—in the water, on dry land, in the air. It may well be that during millions of years of evolution, life on Mars has developed its own drastically different forms. Therefore the term, *life as we know it,* may indeed be too restrictive for the answer we seek.

In 1956 and again in 1958, the American astronomer William M. Sinton discovered certain "absorption bands" characteristic of organic molecules in the infrared spectrum of the dark regions of Mars. These bands also are observed in the spectrum of light reflected by vegetation on Earth. Many astronomers think this discovery provides almost final proof of the existence of plant life on Mars.

Nevertheless, for a definitive answer, it is still safer not to embrace this conclusion —but to await the telemetered messages radioed back by one of our forthcoming Mars probes. ■■

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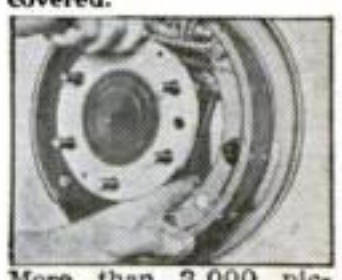
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Getting Ahead

By Dr. Lewis R. Fibel

A monthly column to help you prepare yourself for a better job

More than half of all scientists who have ever lived are at work today. Result: Libraries are faced with an "information explosion." What's needed are science-information specialists—persons who can bring order out of the chaos of words—for libraries and industrial and research institutions. To train them, colleges are initiating programs in "information science." One of the latest is Georgia Institute of Technology, with a program scheduled to begin in September.

A trained mechanic is seldom unemployed, says J. F. Buck, service-promotion and training manager of American Motors. Pay and working conditions are good, and the background is ideal for anyone interested in an automotive career. Mechanically inclined high-school students might bear in mind that the industry faces an acute shortage—some sources place it as high as 200,000 men.

"How should I go about becoming a ship's finance officer or purser on an ocean-going liner? I have been associated with banks for over 11 years as a finance officer."—F.B.A., Fort Lauderdale, Fla.

Your general background should be sufficient for such a position. I would suggest that you read *Opportunities in the Merchant Marine* by John J. O'Connor (Vocational Guidance Manuals, Inc., 1011 East Tremont Ave., NYC 60). Included is a list of American ship owners to whom you might write.

"Where can I take a course in agriculture by correspondence?"—T.A., Cashion, Ariz.

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American Technical Society, 850 E. 58 St., Chicago 37.

Many colleges also offer correspondence courses in agriculture. Two that might interest you are:

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These and others are listed in a directory (25¢) you can get from the National University Extension Assn., Business Office, Building TSMc, Univ. of Minnesota, Minneapolis 14.

When writing to any of the institutions above, address your letters to "Correspondence Study."

"Is there any hope of a high-school girl becoming an astronaut? Where would she start?"—B.S., Swampscott, Mass.

Some psychologists say that women may be better equipped than men as astronauts, and of course the Russians are already training women for space flights. However, the American space program has so far been restricted to men. But this could change; you could make it first to the moon.

Still, there are many other careers for women in the space program. The general direction is to *excel* in high school and in college, and to learn as much as you can about the space program.

"Several people in our department would like to know the names of the best schools of journalism and of photography in the nation. We realize, of course, that this would be your personal opinion, but we would greatly appreciate the advice."—J.F., Editor, "The Western Concept," North Dakota's Western College, Dickinson.

A number of readers have asked me to list the "best" schools in a field. Some believe that there exists some secret service that rates schools or colleges. There just isn't. Further, no individual, including myself, can possibly have enough personal knowledge to compile a list of his own.

Probably no schools are really "best." Some may be better for one person, others for another. Ideally you want the best match of student and school.

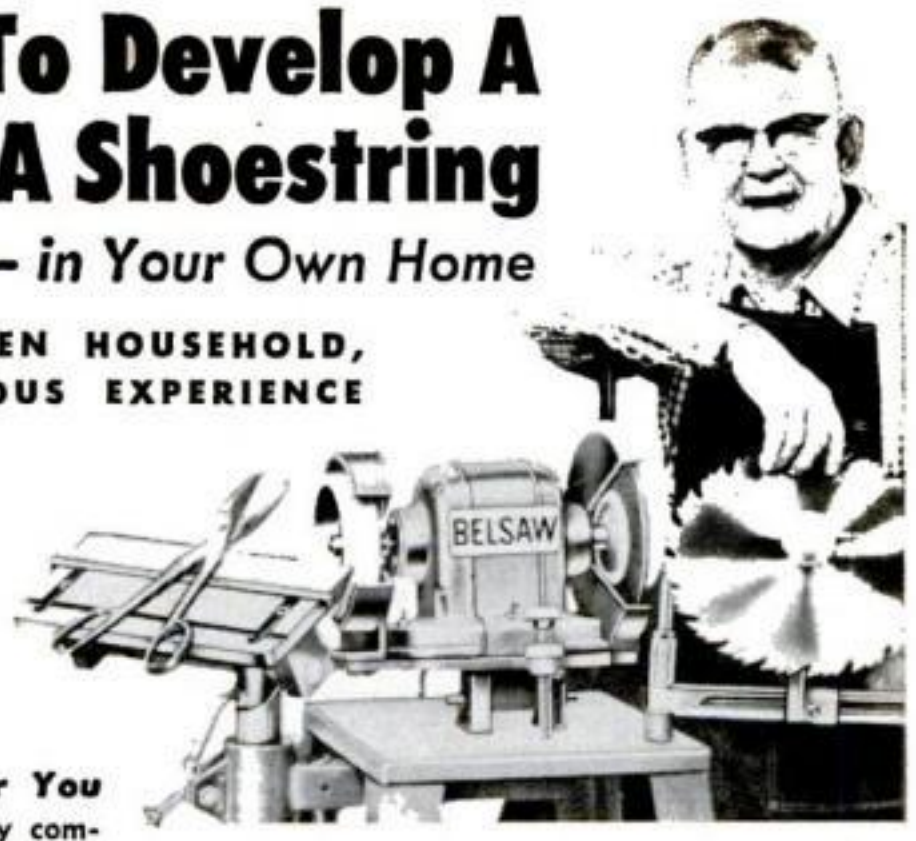
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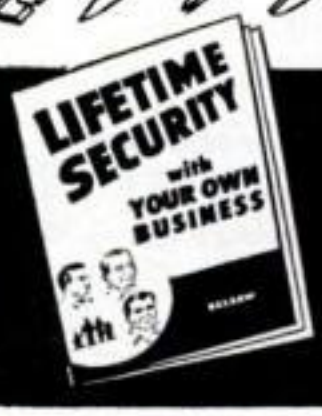


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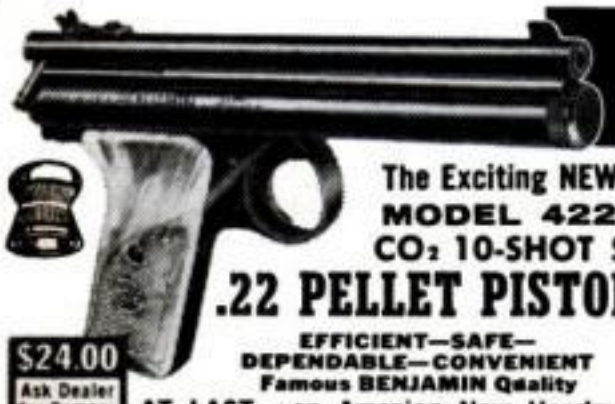
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if it meets the minimum standards of acceptability of an accreditation board. The American Council on Education for Journalism is the accepted accrediting agency in that field. Its latest list has 46 approved schools in 33 states. Some of these offer programs in photo-journalism, but there is no separate accrediting agency specifically in that field.

"I am 39 and interested in becoming a computer service-and-installation technician. Would a good electronics course be a prerequisite?"—L.C.G., Fairport Harbor, Ohio.

Yes, an electronics course would be a good start towards a computer service career. These Cleveland schools may help:

Adult Education Foundation Griswold Institute, 2325 Chester Ave.

Cleveland Engineering Institute, 6300 Euclid Ave.

Fairchild Technical Institute, Inc., 2012 W. 25 St.

National Radio and Television School, 4404 Euclid Ave.

You might also want to explore the possibilities of correspondence study.

"I have a B. Sc. in chemistry from Bombay University. I would like to do research in the U.S.A. Is it possible to get a paying research job?"—R.S., Bombay, India.

Your greatest hope would be to secure a fellowship for graduate study that would enable you to continue your education as well as do research. These fellowships have stipends, but they rarely pay enough to cover all your living expenses as well as passage from India. You can get further information from the local office of the United States Information Agency.

"What schools in western Canada offer courses in marine or naval architecture?" —J.B., Prince Albert, Sask.

None that I know of. The Engineers' Council for Professional Development lists the Univ. of California (Berkeley), Univ. of Michigan (Ann Arbor), Mass. Inst. of Technology (Cambridge), and the Webb Inst. of Naval Architecture (Glen Cove, N.Y.).

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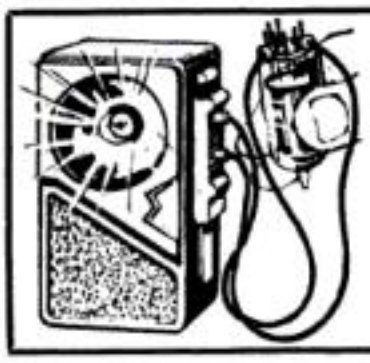
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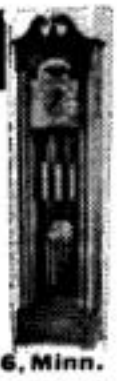
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Detroit report

By Devon Francis

Wax protects new cars

An electrostatically applied coat of wax is being used by many Detroit manufacturers to protect car paint and trim from diesel fumes, road grime, and gravel thrown up from railroad tracks while cars are transported from factory to dealer.

An applicator nozzle gives the wax an electrical charge. The grounded car on the production line is given a negative charge. This causes the wax to be attracted magnetically to the body and trim. Glass, rubber, and plastic components are nonconductors and stay pretty much unwaxed.

Two years ago Chevrolet and Studebaker began applying the wax at the end of the production line. Pontiac and Buick followed last year. Oldsmobile also has begun waxing; Cadillac will start this summer.

This spring American Motors sent a load of cars—half waxed, half unwaxed—on a test run to Florida. The results convinced them to use the process. Ford and Chrysler are expected to start in 1964.

Peekaboo headlights

One of the most successful new features in 1963 is the retractable headlights on the Corvette Sting Ray. Other cars—most likely Buick Riviera, Chrysler, and Thunderbird—probably will have them by 1965.

Besides streamlining appearance, retractable lights reduce wind resistance, thus increasing gas mileage and top speed.

Overhead cam for Pontiac

Pontiac's in-line engine with overhead camshaft (to power its Tempest) resorts to a unique solution of a problem that has always plagued this design.

The cam is driven by the crankshaft through an exposed timing chain at the front of the engine. Big advantage: The dozen or more pushrods that normally actuate the valves are eliminated. This allows a lighter, stronger block and, more important, a more efficiently shaped combustion chamber.

A problem with OHC timing chains has been stretching of the links, a result of the long chain needed. A device was required to take in the slack gradually. Pontiac reportedly has partly solved the problem by using a forged-aluminum head, which can be made lower than a cast head, thus shortening the timing chain.

Age of the "personal car"

Independent auto-engineering firms in Detroit are loaded with work, bearing out the statement of one supplier that many more specialty, or limited-production, cars will be forthcoming in the next few years.

Sparking the gas turbine

One of the interesting features of Chrysler Corp.'s turbine car is its unusual starter-generator combination mounted on the accessory case at the front of the engine.

On starting the engine, the starter-generator acts as a motor and rotates the gas generator and accessories until the engine fires and the first-stage turbine begins to accelerate under its own power. The starter circuitry then disengages and the field current is introduced to the generator, which supplies direct current to the car's electrical equipment.

Tires and high speeds

A major problem for tire makers is the high speeds possible on modern expressways. This is causing a good deal of "chunking"—chunks of tread breaking off the tire.

Goodyear is now testing a synthetic spray that reportedly eliminates chunking and prolongs tire life.

Ferrari-Ford merger?

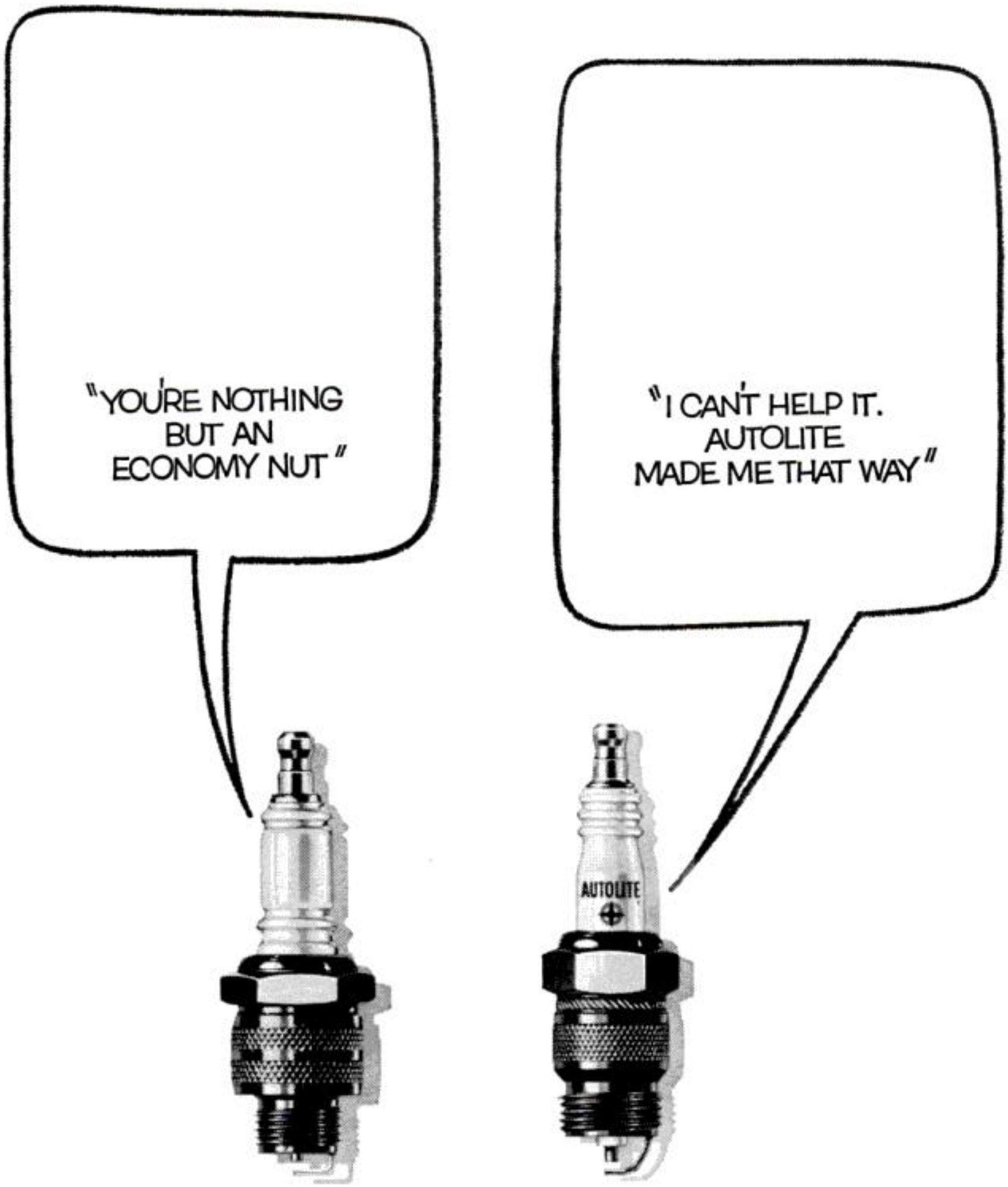
For a time, it looked as though the famous Italian Ferrari sports and racing cars would be coming out under the Ford brand name. Negotiations were in progress for Ford to acquire Ferrari for a reported $16 million. Now the deal is off.

Oval track for California

Construction of the $17,000,000 California Motor Speedway, headed up by Sam Hanks, winner of the 1957 Indianapolis 500, will begin next spring near Ontario. Completion is scheduled for fall of 1965.

The 2½-mile racing surface will have a configuration identical to that of the Indianapolis Speedway, and will be used for both Indianapolis-type and stock-car racing. The track will hold 250,000 spectators.

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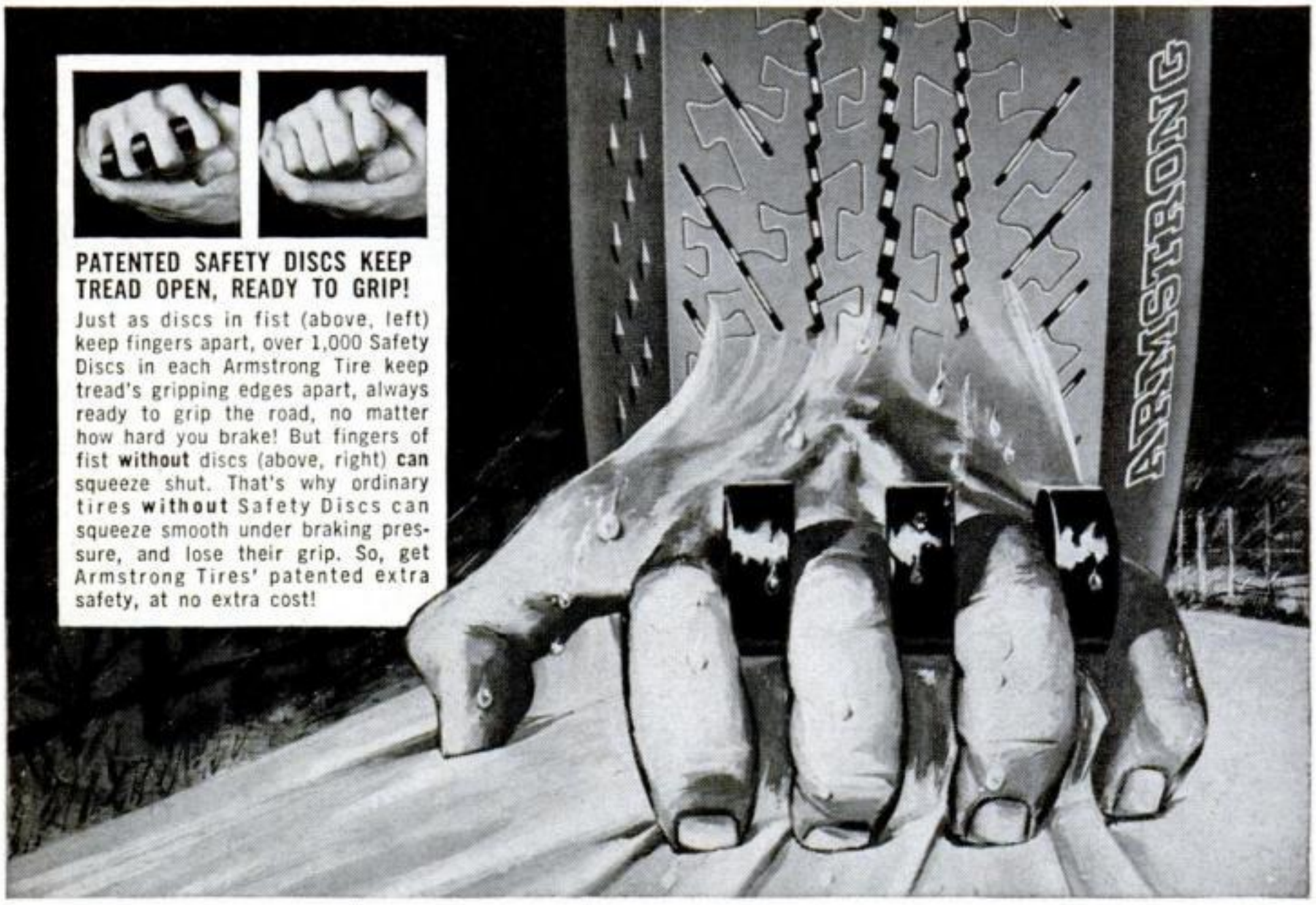
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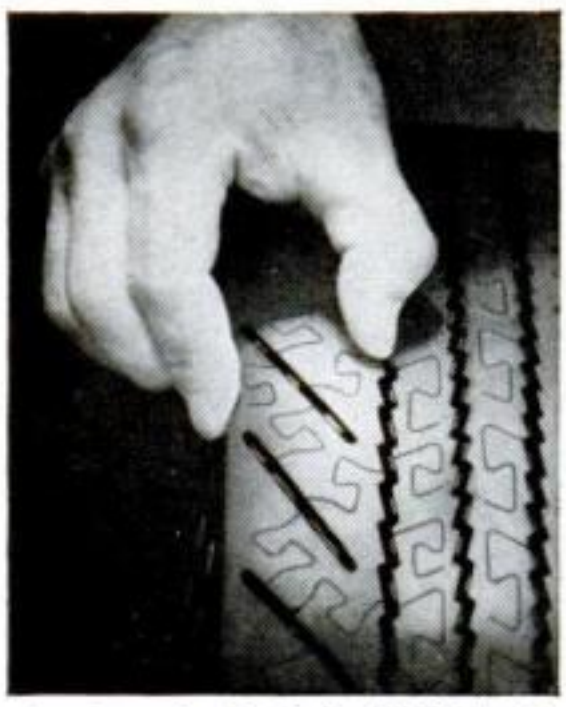
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Popular Science Monthly
REG. U. S. PAT. OFF.

How to Get Towed Without Getting Took

By E. D. Fales Jr.



**Trouble on the road?
Watch out for the clowns and crooks
who are experts only at padding
bills and ruining cars**

Tow man Jack Logan shows one good way to hoist a car.

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Here's how a fork-lift tow rig is set up

BE CAREFUL next time you need a tow. It's tricky business. Cars today are bulkier and more sensitive, and chances of damage are increasing. In Virginia, recently, an improperly towed car caught fire. Near Poughkeepsie, N.Y., a tow man put a hook through a bumper.

In another town a car being towed by an untrained tow driver rolled over. A Midwestern tow man looked back, found he had no tow. "It had fallen off a mile back," he told me.

Near Newark, N.J., the transmission of a towed car began to smoke. Moments later it froze up. There was a snapping sound and the drive shaft went bouncing down the street.

Worst of all, some mechanical damage may not show up until later.

Not all tow damage is accidental. Some unscrupulous tow drivers have been caught deliberately damaging cars to run up repair bills.

Your best protection is to get towed by an expert. But thousands of garages still send out untrained tow drivers. They have to, for good drivers and mechanics are scarce. Often these amateurs learn at your expense.

To protect your car, you yourself have to know how it should be towed. Should it be forward or backward? Don't count on an untrained tow man to know. Even the factory charts are confusing. Where should chains be attached? And how should your car be prepared for towing —so it won't come back with a twisted bumper or bent tie rod?

You can't get all the answers from owners' manuals. The manuals are brief, sometimes written to make things sound easy. Some are downright wrong.

You can't even get the answers from all dealers. I asked a dealer how to tow a popular 1963 car. He scratched his head, went to his service department. After a delay he reported back: "*They* don't even know for sure."

To get answers, you have to go to tow men—real hep ones—and, if you have an automatic transmission, to a transmission-repair shop. I interviewed tow men in six states. Then I went to Lee Myles, a top transmission-repair expert from Maspeth, N.Y. Here are their tips:

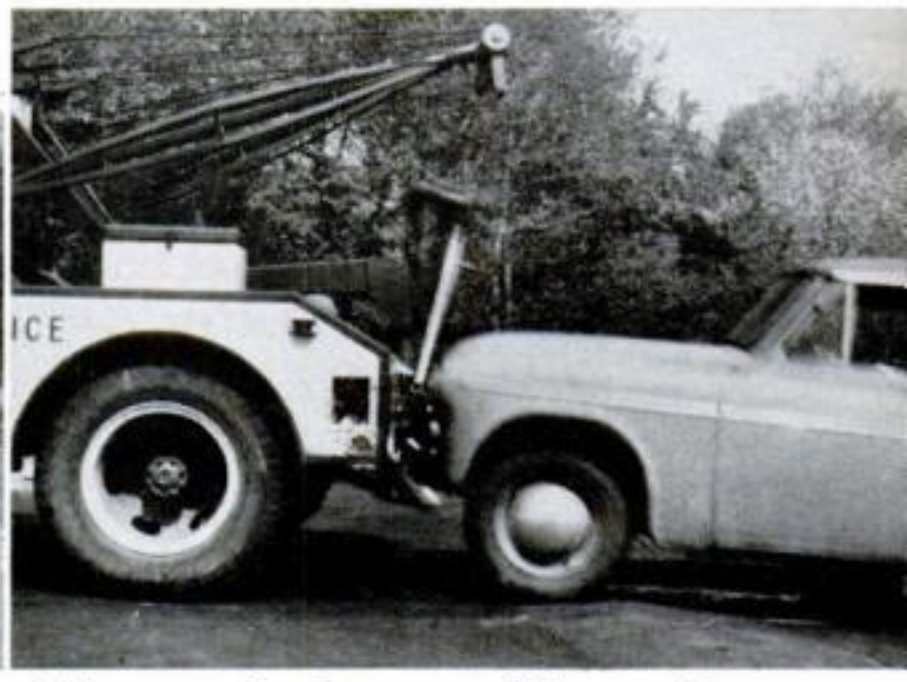
Don't get flustered. All drivers, even during minor emergencies, are nervous. Many don't know, later, who took their cars away. They can become victims of carelessness, deliberate damage, overcharging. Get out pencil and paper on the scene and note down everything. This will also help you think.

Do you really need a tow? In Chicago, after a minor collision, it cost one driver

Many grilles and bumpers are smashed like this

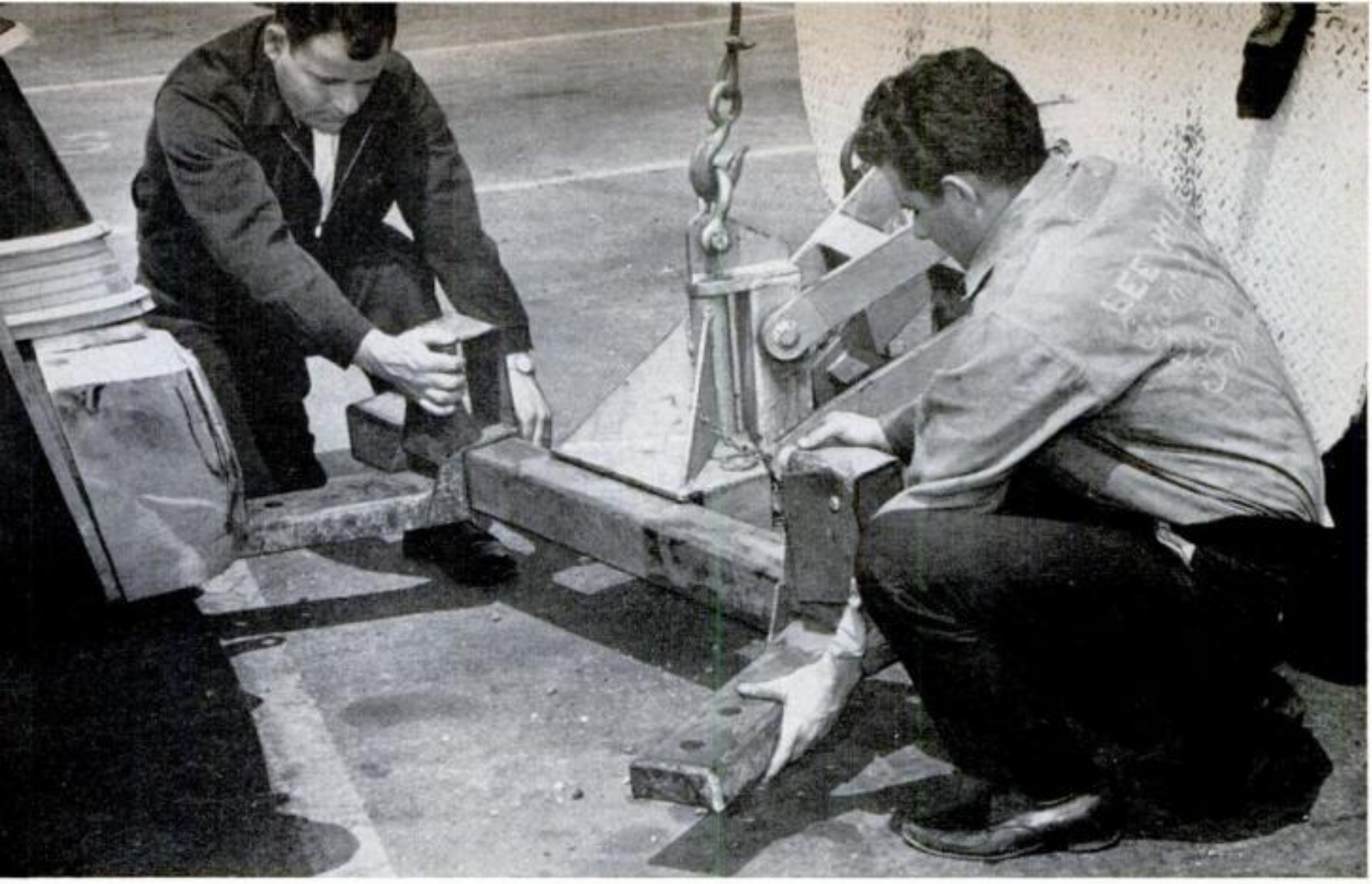


Flat towing like this causes many smashups. If motor starts, or tow truck slows (or turns), car often rams the truck. Cable jerks also can damage the front end.

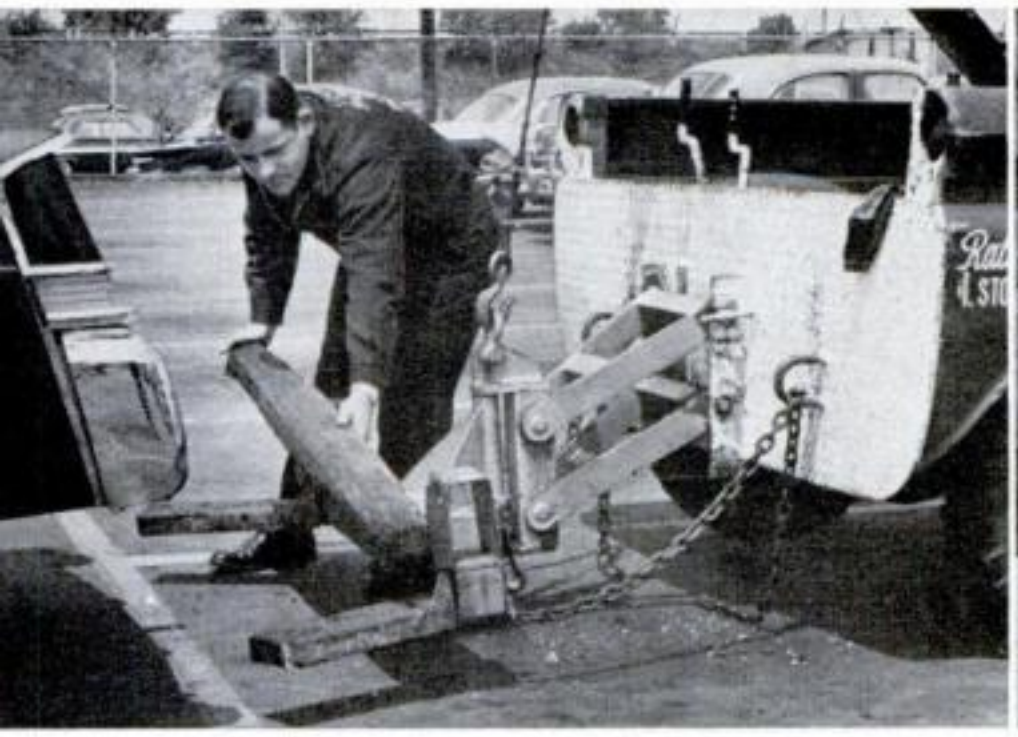


When untrained tow man lifts car, this may happen: Emergency brake is released, car jumps ahead, smashes nose.

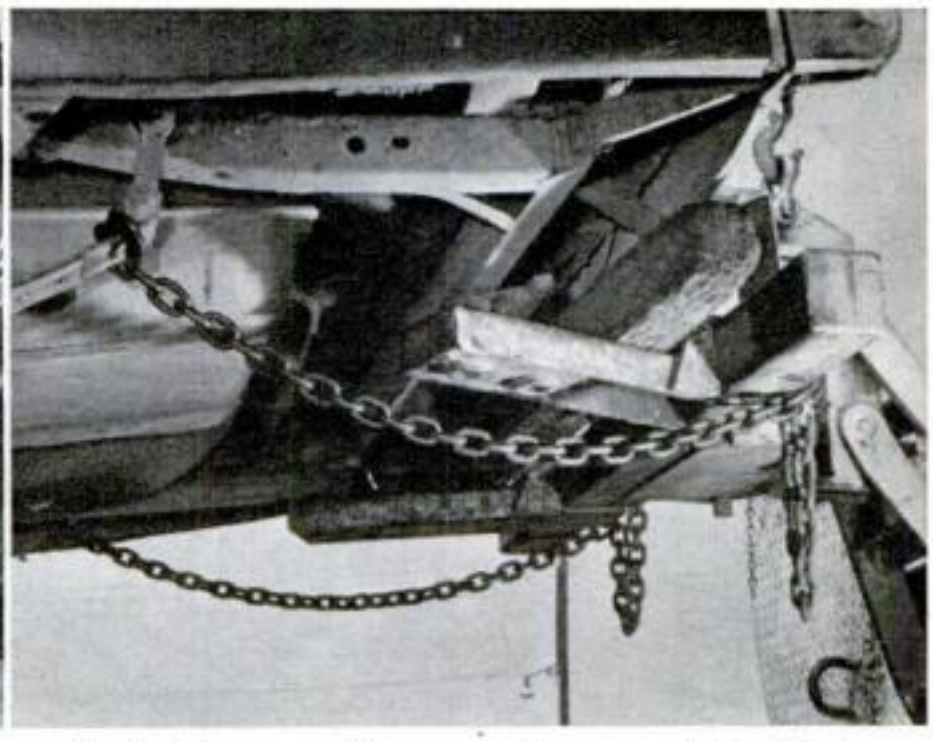
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How drivers are taught to use fork lift at Lee Myles's shop is shown by Jack Logan (left). Fingers are widened to clear gas tank. Forks thrust under frame take car's weight.



Protective four-by-four timber, a must for tow cars, is placed on forks. Double A-frame security rig prevents surging back and forth.



Fork fingers lift car, whose weight falls on timber. Chains from leaf springs now do no lifting, merely secure car to fingers.

$25 to be towed three blocks. He didn't need a tow; his fender, rubbing a tire, could have been bent clear in seconds with a pry bar.

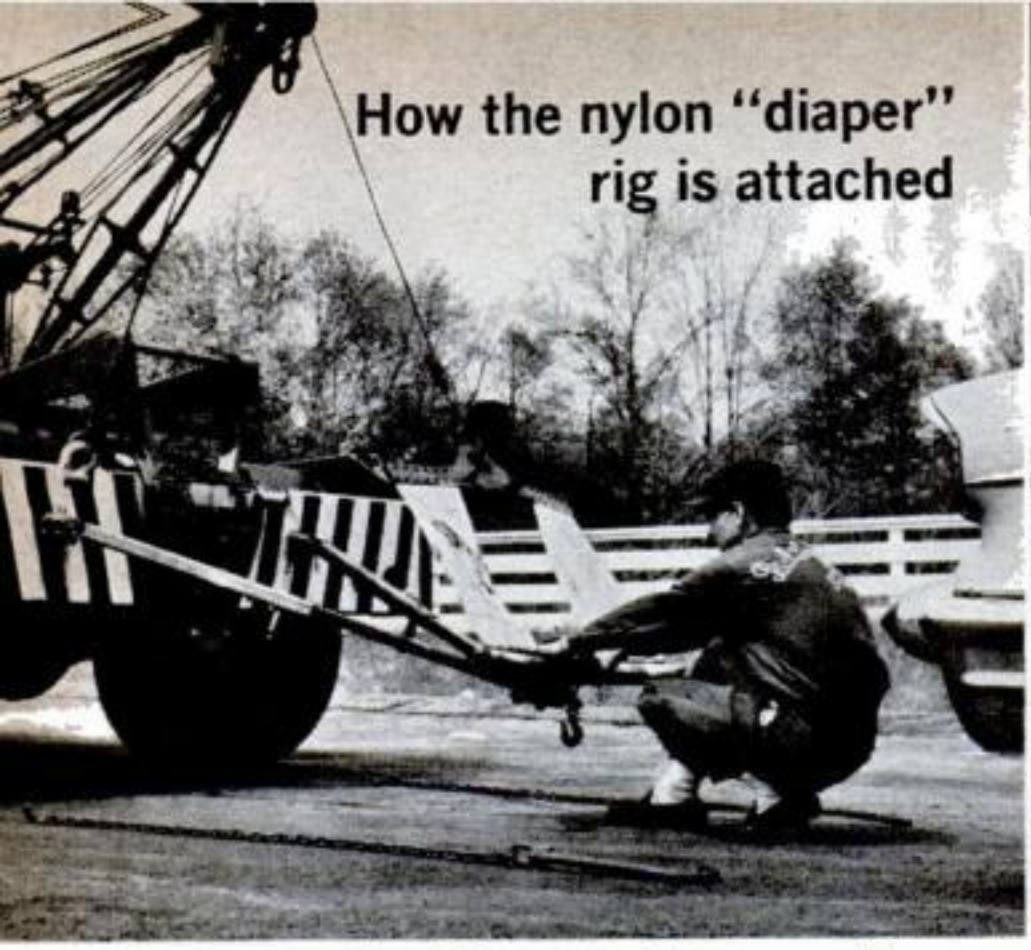
Paul Longo, a tow man who runs a Gulf station at Darien, Conn., says: "Seventy percent of the people who get towed for engine trouble don't need towing. We just send a man with gas, pliers, screwdriver, points, and an ignition test light."

If a tow *is* necessary, find out what it will cost. A lot of gougers have sprung up, especially around some controlled-access roads where competition is limited.

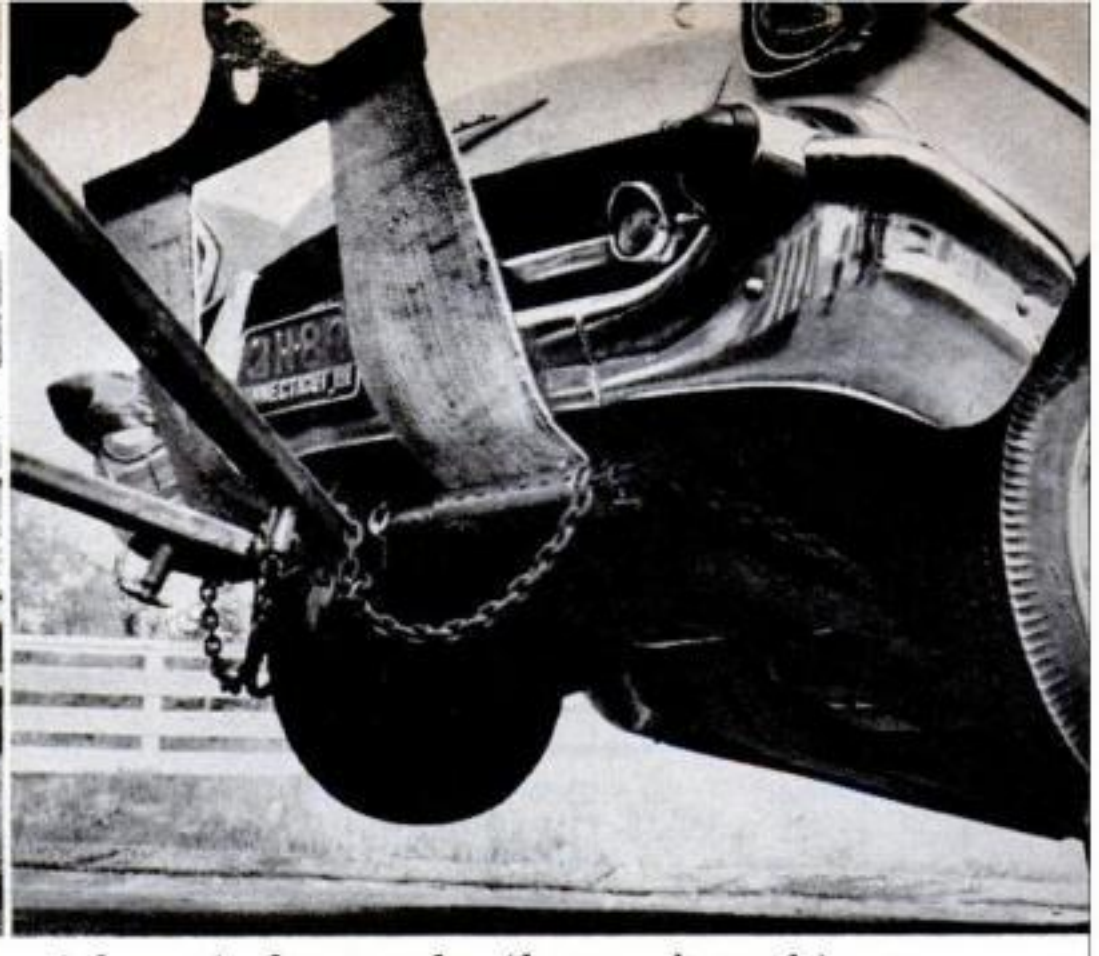
Near White Plains, N.Y., recently, it cost a man $37 to be towed a quarter of a mile off a super-road exit so he could repair his own flat. Near Philadelphia, one man paid $7.50 to be towed 10 feet through a tollgate. Another paid $27 to be towed two blocks. Still another need-

CONTINUED

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Arriving at breakdown, Paul Longo pulls out a telescoping A-frame. Nylon diaper strips hanging above it will cradle bumper. Note two chains with hooks ready on road.



A-frame is thrust under (but won't touch) car. Spreader bar is under car, and chains from each end run to safe tow points. The nylon diapers gently lift the bumper as the car rises.

ed a tire change on one of the big throughways, where only "permit" tow trucks can operate. A serviceman came, changed the tire, handed him a bill for $20.

"I used the crane-hoist for a jack," he said, "and that makes it a tow trip."

Before your car is taken away, use that pencil and paper. With the tow man, note all damage. But also note "non-damage." If windshield and roof are perfect, write it down. If the grille is perfect, note it. Now you have a checklist—and the tow man knows it.

Lee Myles considers this so important that he has his tow men hand you a "car condition" form. You and the driver both initial it.

Also write out a tow-authorization order (required in some areas). This tells the tow man where to take the car, specifies what protection you want (tarpaulin to cover any damage, spilled battery to be removed, etc.), and storage price, if any.

What kind of tow do you need? Five kinds of towing are used:

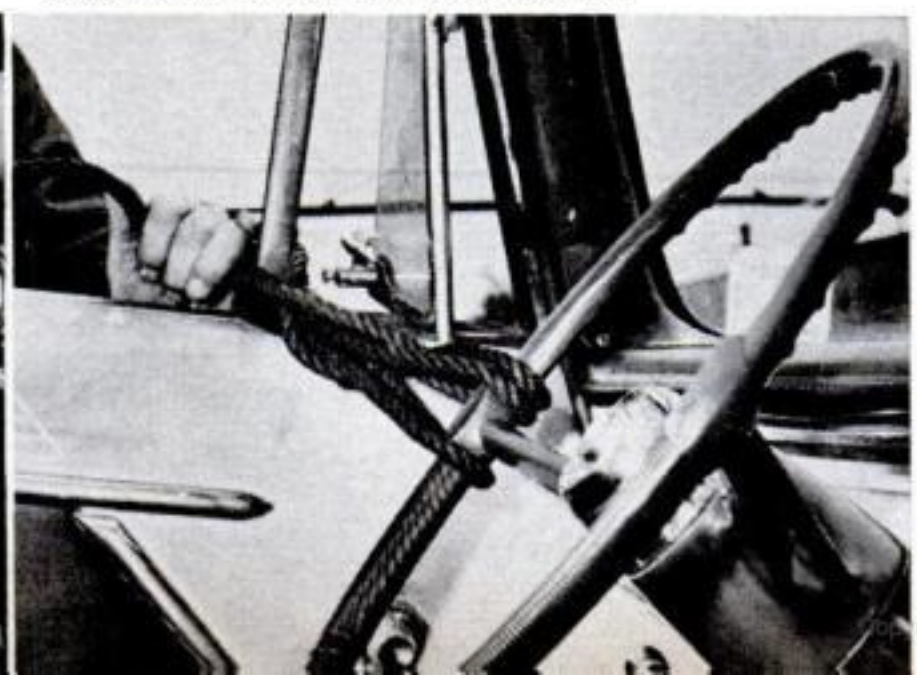
Pushing. Carefully done by a truck with a cushioned bumper, pushing is used to start some stalled cars or nudge others out of traffic so they can be hooked up for towing.

But pushing is dangerous, can damage most automatic transmissions if done for any distance at any speed, and has caused many collisions. It should be avoided or, in emergency, limited to a few yards.

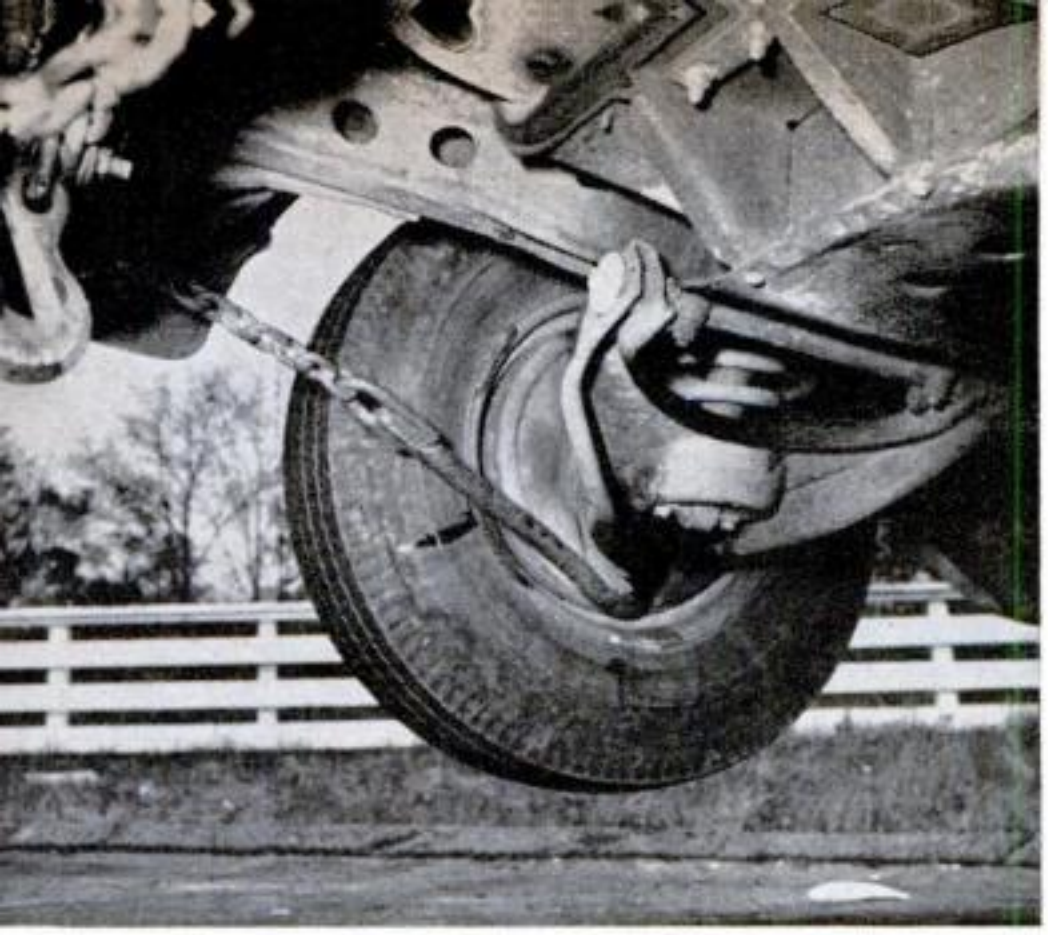
For rear-end tows, the safe way to tow automatic-transmission car, Longo uses spring-loaded steering rig. Two "hands" grip wheel.



Rope tie is still used by Lee Myles's drivers. Rope should never be tied to door handle. Three loops are needed for a safe grip.



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Tow hooks lead to each front-wheel A-frame and chains are tightened before lift begins. For stability and to prevent rear-end damage, wheels should not lift more than a foot or so.

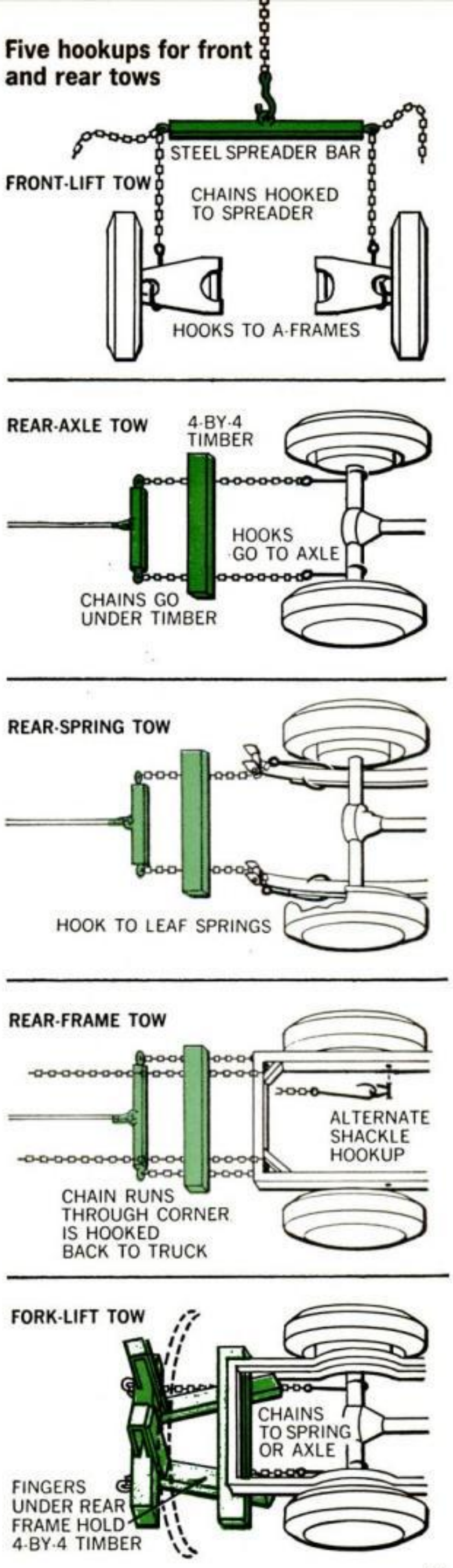
If used to start an automatic-transmission car, you should determine from your manual which shift position is correct. Some Ford and General Motors cars start in Low, some in Drive. All Chrysler cars start in Low. A Studebaker Automatic Drive starts in either position, but Studebaker Flightomatics must be started in Low and Ultramatics in Drive. And a Rambler "E" Stick has a tow-start handle that must be pulled. Certain recent Cadillacs, Oldsmobiles, and Pontiacs can't be push-started at all.

Flat towing. Here, your car is pulled on all four wheels while you steer. It's even riskier than pushing. If you accept a flat tow, top speed should be 15 m.p.h. —which is suicide on fast pikes. Never risk a flat tow except on a slow, quiet street.

Front-end crane-towing. With front wheels hoisted, your car is pulled on its rear wheels. It's okay for standard-transmission and most overdrive cars when in neutral.

Unless an expert is towing, however, never let an automatic-transmission car be front-towed. Some manuals may disagree, but it's the strong advice of many careful tow men who have seen automatic transmissions come in smoking hot

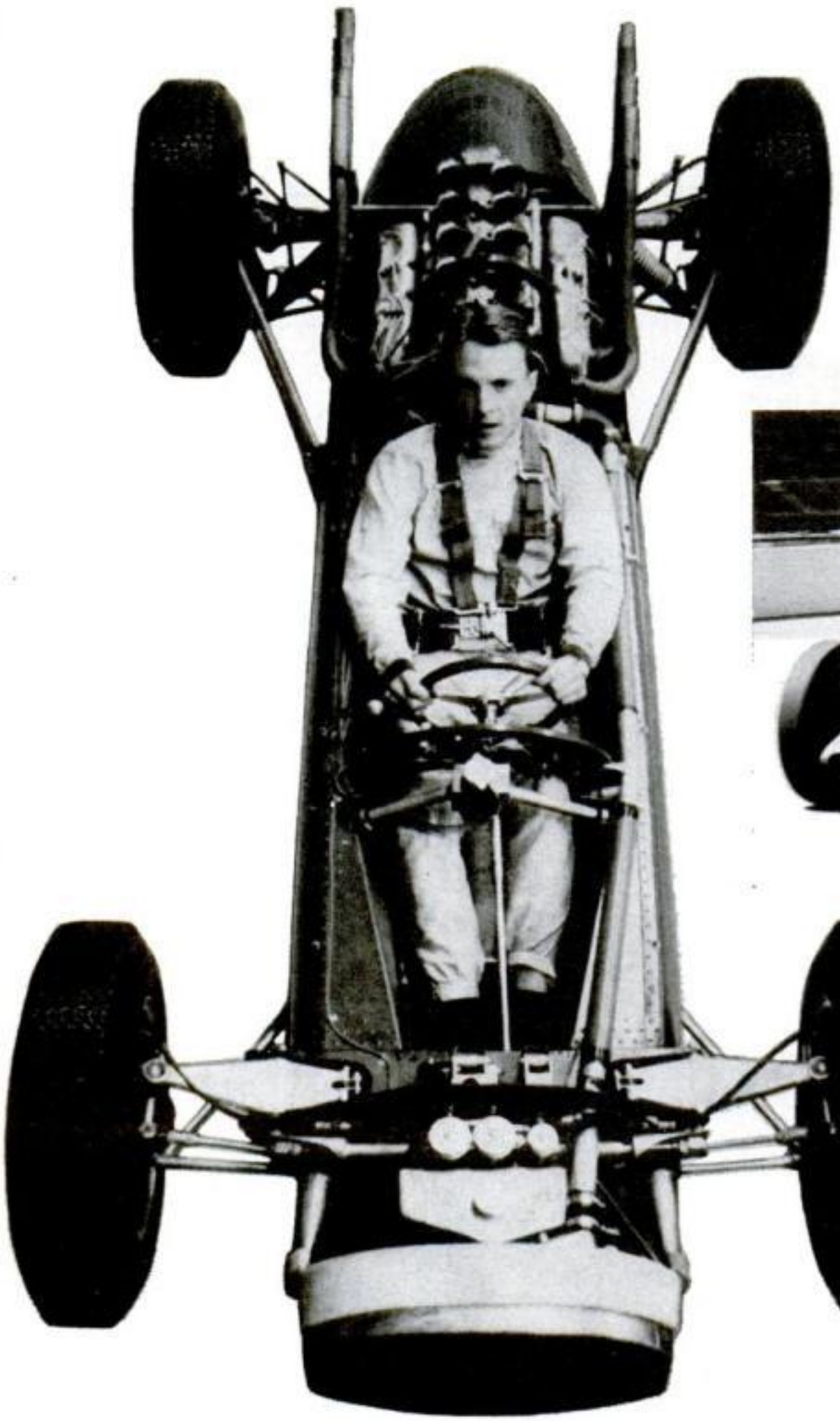
[*Continued on page 152*]



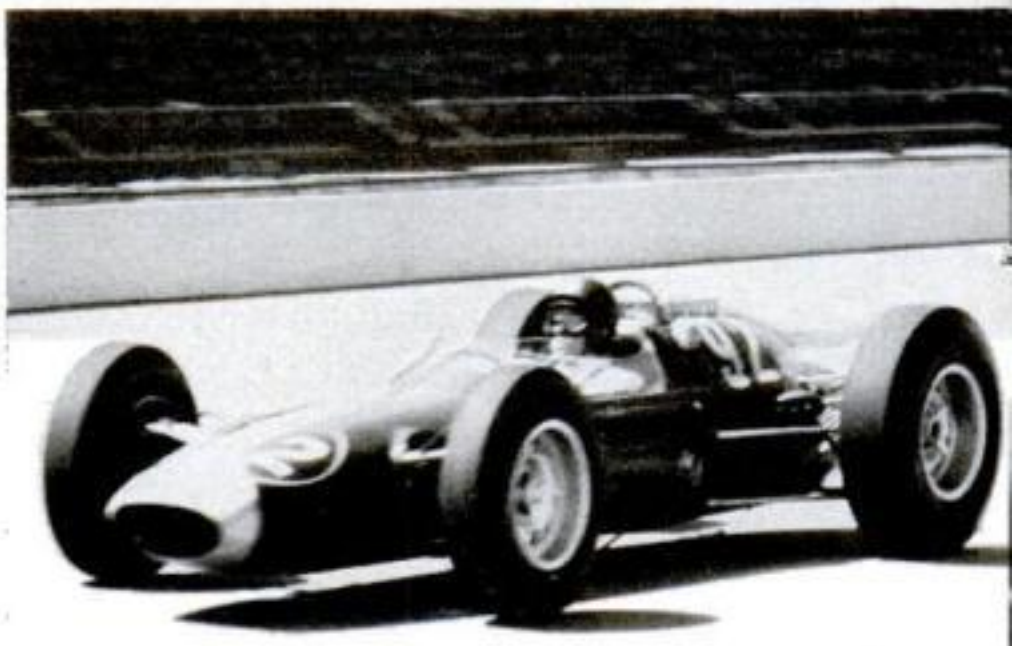
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LOTUS FORD AT INDY:

The Little Engine That Almost Did

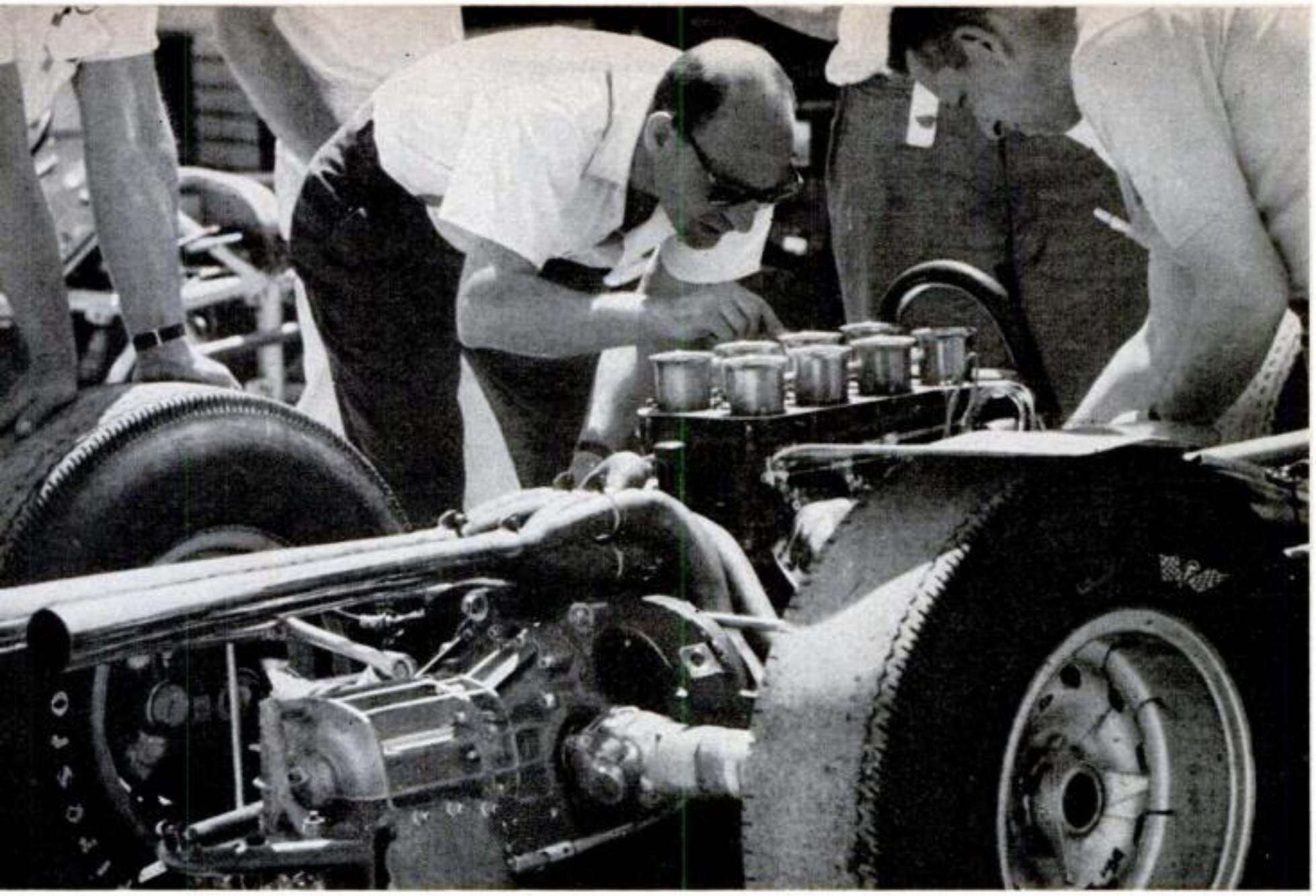


How to drive lying down: Cutaway version of Lotus Ford that Dan Gurney drove to seventh place at Indianapolis shows how his reclining position behind wheel lowers car's silhouette to less than three feet.



Canny Scot comes close. Jim Clark of Berwickshire, Scotland, drives a practice run (above) in the Ford-powered car that almost made racing history in this year's Indy classic. Clark was leading winner Parnelli Jones for 20 laps in the middle of the 500-mile race—finished second.

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Renato Vito of Bologna, Italy, checks over special Weber carburetors on a Lotus before race.

By Devon Francis

A DETROIT-MANUFACTURED engine came pretty close to winning the world's classic of bowl auto racing, the Indianapolis "500," a few weeks ago, and it shook up not only the racing fraternity but the auto industry as well.

Every year since 1934, with only three exceptions, four-cylinder special racing engines of a single design had dominated this race. Now along came an upstart—the Ford Motor Co., by name—with the gall to run the race with an engine patterned after that in some of its passenger cars.

The standard engine at the Indianapolis Memorial Day race is a Meyer-Drake, more commonly known as the Offenhauser, or "Offy." It's heavy. It's rugged. With overhead camshaft and fuel injection, the mill is built for the job.

The Ford racing engine was adapted from the one that powers the company's Fairlane and some Galaxie models. It had a standard cam in the valley between the two banks of four cylinders each, and just plain carburetors. And of all things, it ran on gasoline instead of that exotic pabulum burned by the Offy, alcohol and "nitro."

[*Continued on page 158*]

	LOTUS FORD	OFFENHAUSER
Horsepower	376 at 7,200 r.p.m.	400 at 6,000 r.p.m.
Compression ratio	12.5:1	16:1
Car weight, dry	1,150 lb.	1,550 lb.
Wheel tread	56⅝ in.	54.5 in.
Engine displacement	255 cu. in.	255 cu. in.
Fuel capacity	50 gal.	50 gal.
Fuel type	Gasoline	Alcohol
Oil-tank capacity	4 gal.	8 gal.
Wheelbase	96 in.	95 in.
Engine weight	343 lb.	540 lb.
Tire size, rear	820x15	800x18 (820x15 opt.)
Tire size, front	740x15	760x16
Carburetion	Four 2-bbl. carbs	Fuel injection
Ignition	Distributor (battery)	Magneto
Engine type	Ford V-8 OHV	Offenhauser 4-cyl. OHC
Engine location	Rear	Front
Spark plugs	Autolite	Autolite

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Want a thrilling Alpine-style ride by cable car? Try this one

World's Longest Aerial Tramway

By Ross R. Olney

NEXT month, two big yellow-orange cars traveling on overhead cables will begin giving passengers the longest aerial-tramway ride in the world.

For snow sports and sightseeing, the $7,700,000 California line will whisk riders from the desert heat of Chino Canyon, on the outskirts of Palm Springs, to a wintry playground 5,873 feet higher on Mt. San Jacinto. The 2½-mile trip will take eight minutes. As one car goes up, the other will descend with returning passengers.

Each 18-foot-long car holds an operator and up to 80 standing passengers.

CONTINUED

Spectacular 2½-mile ride on California tramway starts ascent from Valley Station, below.



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right here in the U.S.A.



End of ascent lands riders on snowy Mt. San Jacinto at Mountain Station (above), not far below mountain's 10,804-foot peak. As one car goes up, the other one descends with returning passengers.





Big 80-passenger car travels on aerial track of twin cables, nearly two inches thick, passing over five towers. Either cable alone could safely support more than three times a loaded car's weight. Machinery at lower station drives hauling cables that propel cars.

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To build tramway, this husky hoist at upper station's site pulled cables up mountain. Photo gives glimpse, past towers in background, of breathtaking view from top of line.

They may grasp a handrail, but hardly need to, at the cars' moderate average speed of less than 20 m.p.h. Head room is ample to carry skis upright.

Motive power is provided at the lower station by a 780-hp. electric motor turning a bull wheel, over which pass the hauling cables for the two cars. As cars arrive at upper and lower stations, an electronic control like that of an elevator brings them to a smooth stop.

Doors will be opened and closed by a car operator, who will be in constant touch by phone with the other car and both stations. Present plans call for one of the operators to direct the movements of both cars, as in Europe.

The longest haul. Not even the famed cable cars of Europe's Alps offer a single ride as far as this one. Europe has longer aerial-tramway routes—but they are made up of a series of separate hauls, and passengers change cars from one stage to the next. A nonstop ride of 11,109 feet on Italy's Trento-Paganella Lift is the world's nearest rival to the new 13,200-foot Palm Springs Aerial Tramway.

The tramway's conquest of towering Mt. San Jacinto has been an engineering feat as spectacular as the ride on the finished line. Tumbling boulders demolished eight huge bulldozers, just in building the approach—a four-mile road from downtown Palm Springs up rugged Chino Canyon to the site of Valley Station, the line's lower end (elevation 2,643 feet).

Then came the task of erecting steel towers on granite cliffs so precipitous that four of the five tower sites could be reached only by air. First a helicopter dropped a single workman with materials to build a temporary wooden landing platform, 20 feet square. Then the "choppers" flew in more workers, materials for a foundation—and the tower, piece by piece, for erection.

Most critical moment in the line's building was the "cable pulling" that put up its aerial track. In preparation, 20-foot-long rock bolts fused the upper, or Mountain Station, site into a solid anchor block of granite. A gasoline-powered hoist was flown piecemeal to the top and assembled there. From lower station to upper one, over the towers, a helicopter carried a length of string. Using this, the hoist in turn pulled up a rope, a ¾-inch wire cable, and then a 1⅜-inch wire cable.

Finally a pulling force of nearly 100 tons brought the big 1⅜-inch track cable itself slithering up over the towers. Had a sudden strain parted it, a whipping cable could have wrecked two or three towers and done millions of dollars' damage—but all four cables went up without mishap.

At recent count, the helicopters had made some 23,000 flights, and airlifted more than 8,000 tons. And the line's builders, despite their perilous jobs, could boast a proud safety record: no deaths, no injuries.

The completed Valley Station, now five easy minutes by car or bus from Palm Springs' center, gives a view of the

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whole aerial line—from a waiting room with 24-foot-high windows, an outdoor observation terrace, and the control room. A ticket window and coffee shop are on the main floor, from which passengers reach a platform to board cars.

The big view. Alighting at the skyline terminus, Mountain Station (elevation 8,516 feet), skiers and hikers will press on to a natural recreation spot behind it—Long Valley—or to higher slopes. Tourists less athletically inclined may tarry at the station to enjoy dining, dancing, and the magnificent view in all directions, before taking a descending car.

The new tramway has been built and will be operated by a State agency, the Mt. San Jacinto Winter Park Authority. Its aerial cars will run between 8 a.m. and 10 p.m., the year round. ■ ■





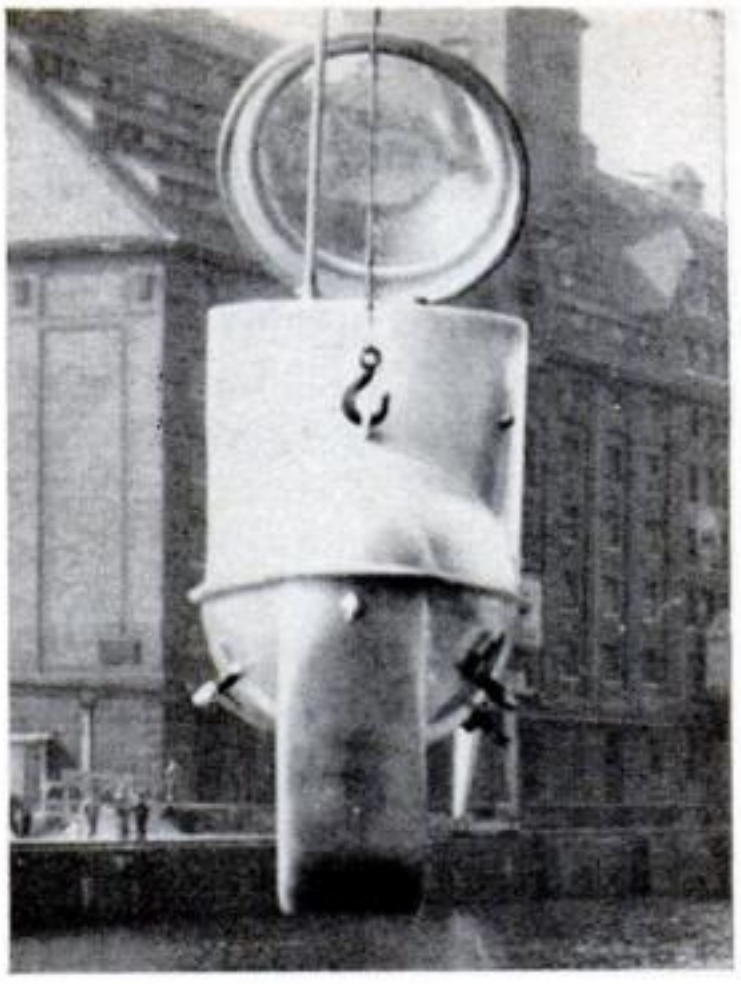
Only helicopters could reach tower construction sites, like one at right, high on precipitous face of mountain. Craft landed with supplies on tiny platform near bottom of view. Above, one of same machines brings California's Gov. Pat Brown to inspect Mountain Station site.

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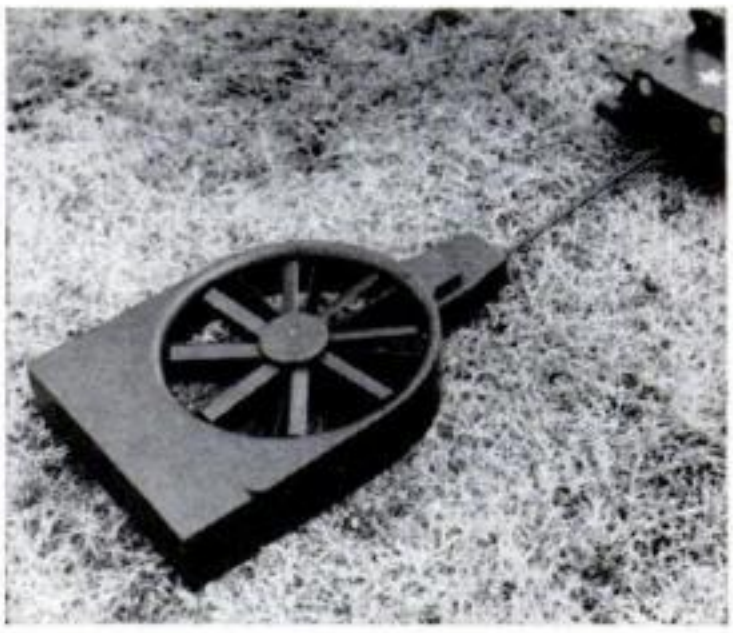
Physical training for spacemen

To get a feel of weightlessness in space, astronaut trainees built this free-turning swing. Approved by the National Aeronautics and Space Administration, it now forms an important part of their exercise. A trainee is strapped to foot and hand rests, gets a push-off, and shifts his body weight back and forth until he can make a full loop. By pivoting, he can also add side spin.



One-man sub: German style

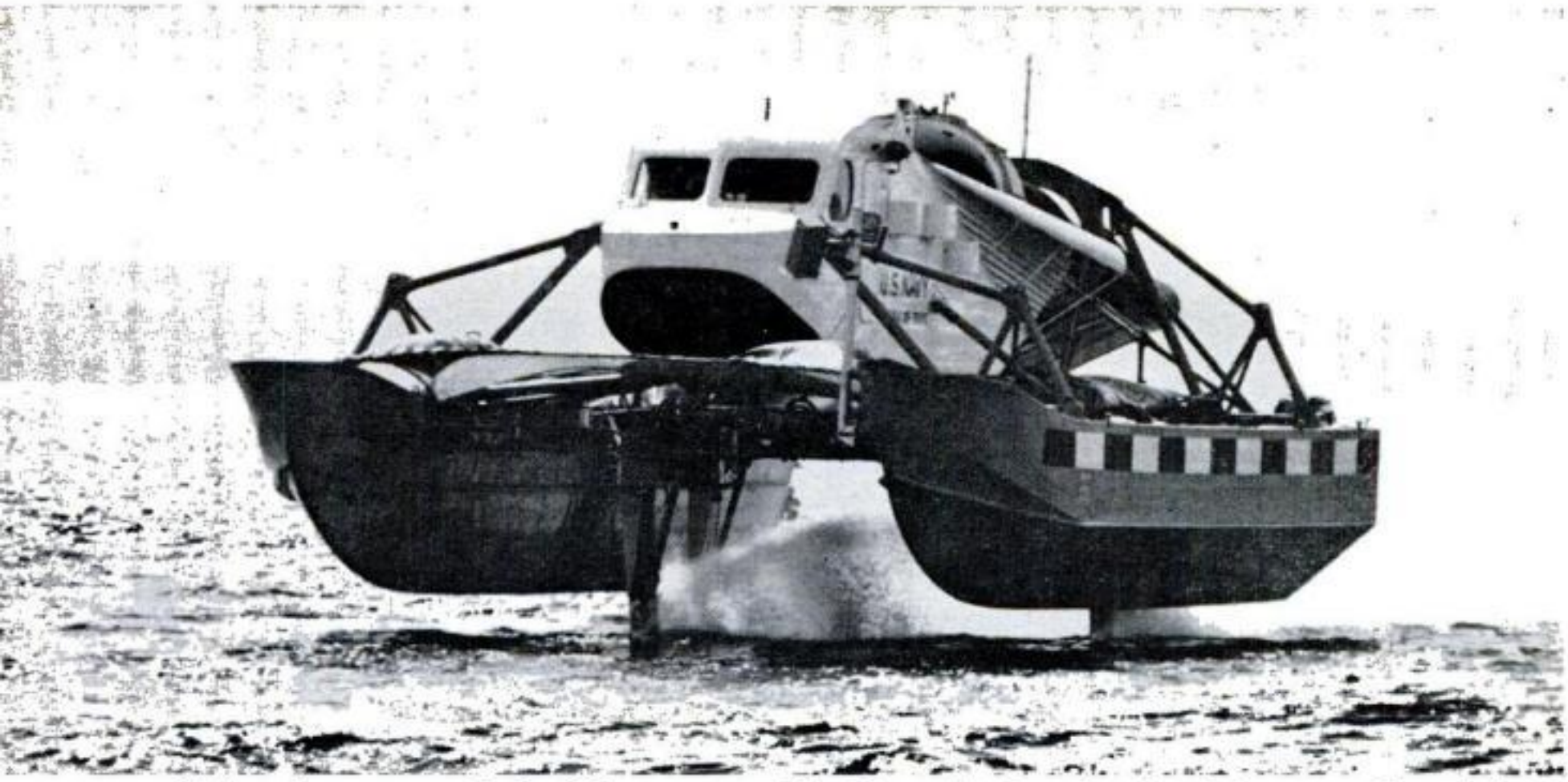
Shown head-on as it was being launched in the Elbe, the one-man submarine above was a hit of this year's Berlin boat show where it was exhibited by Hans Trippel, its inventor. The 7½-foot Delphin dives 100 feet and travels at three m.p.h. A six-volt battery lasts for eight hours. A six-hour air supply can be extended with a snorkel.



Air-cushion mine detector

The Army is testing a land-mine detector that floats on a cushion of air. The eight-foot-diameter ground-effect platform is attached to the front of a Jeep on a hinged 20-foot boom. Built of aluminum and plastic, it weighs less than 300 pounds, including boom. The detector, still experimental, gets its lift from a fan powered by a 72-hp. engine.

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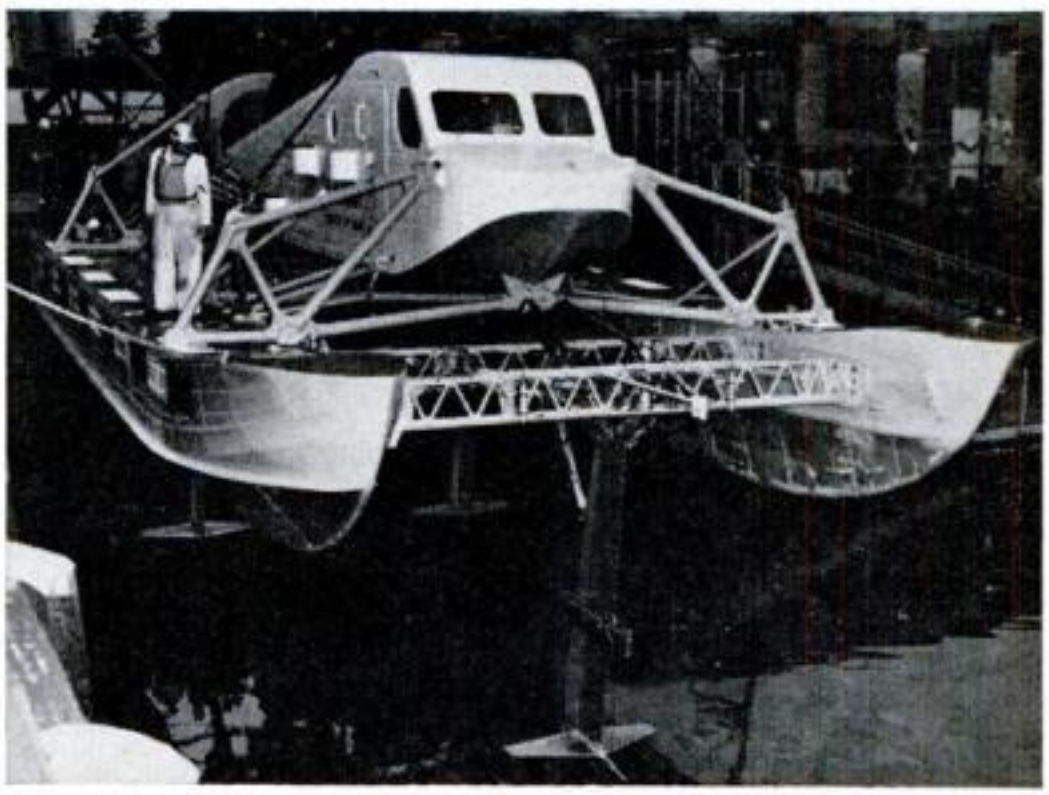


Rising above waves, hydrofoil catamaran hits 60 m.p.h. Navy is using it for research on foils.

High-speed hydrofoils "fly" jet catamaran on water at 60 m.p.h.

Designed to be the world's fastest hydrofoil, the Navy's Fresh I exceeded 60 m.p.h. in its first "flight" over a six-mile test course on Puget Sound. The Fresh (for Foil Research Supercavitating Hydrofoil) is expected to reach up to 90 m.p.h. on its present foil system, 115 m.p.h. after other systems have been installed.

The 15-ton Boeing-built test craft rides on three fully submerged ventilated foils electronically controlled from the cabin. Fixed foil struts and twin 53-foot hulls are mounted on tubular trusses. Power is provided by an above-water fan-jet engine capable of developing 18,000 pounds of thrust. When not "flying," the craft is propelled by two 75-hp. outboards.



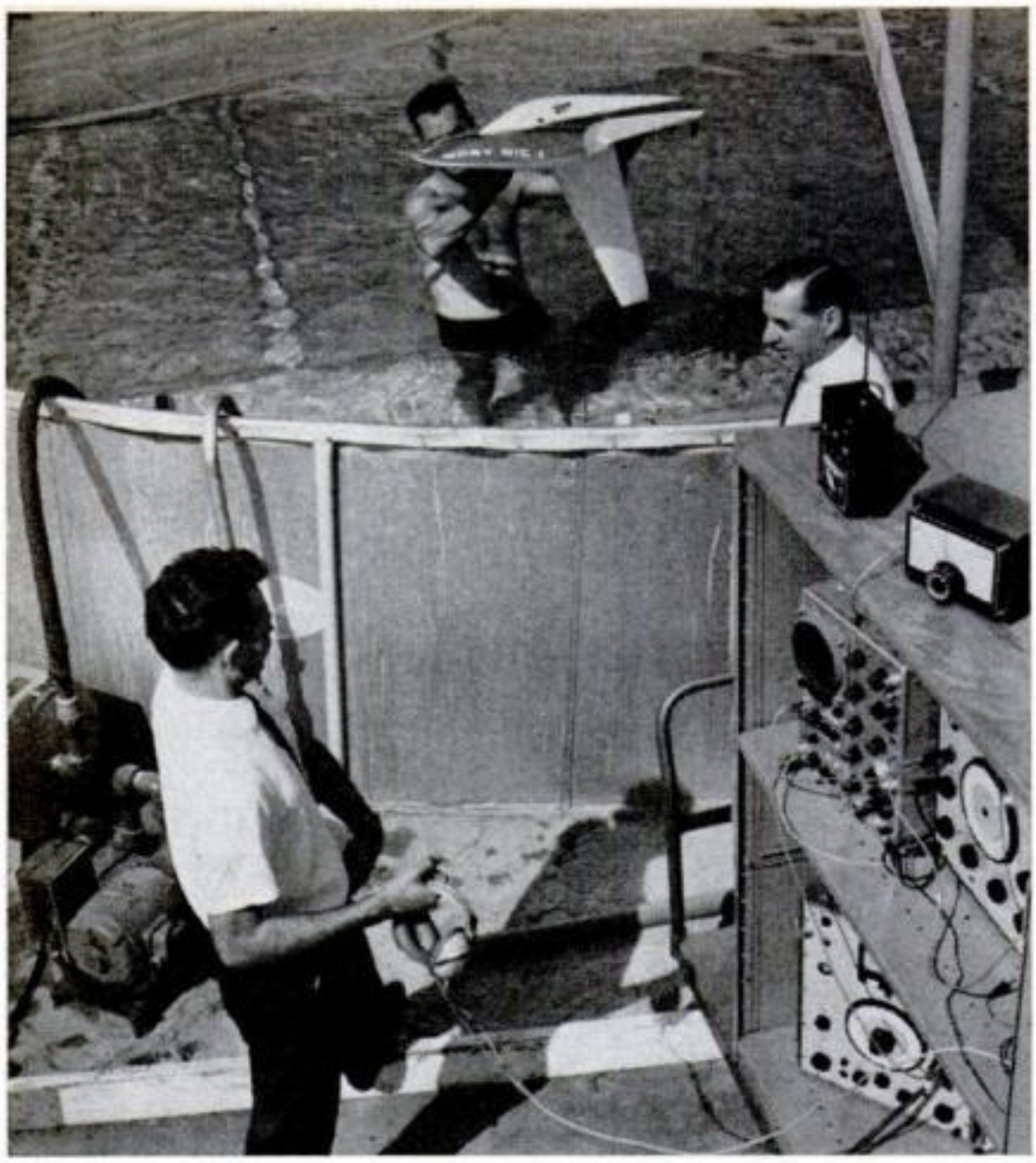
Winglike foils, one at bow and two near stern, are visible on fixed struts as test craft is launched by crane.

Plane adds second engine

Piper's four-place Comanche now also comes in twin-engine form. Powered by two 160-hp. Lycomings under slender, tapered nacelles, the PA-30 Twin cruises at 194 m.p.h., has a top speed of 205 m.p.h. and a range of 1,025 miles. Base price of $33,900 is lowest yet for a two-engine four-seater.

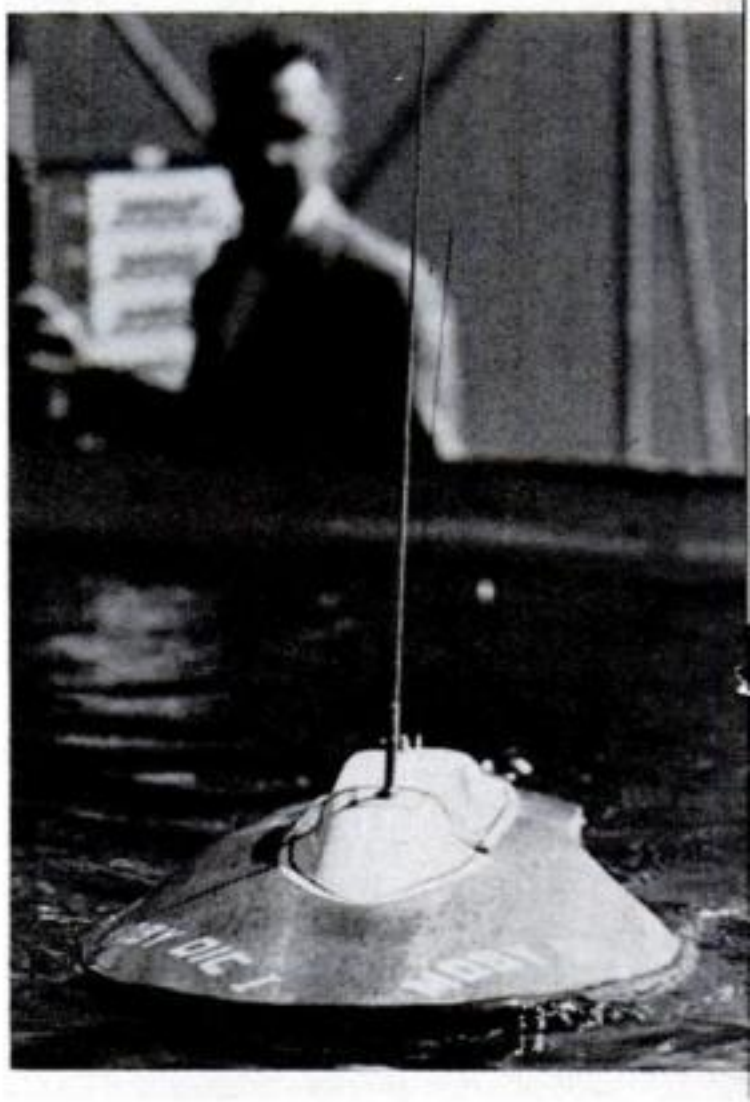


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Small-scale model of Moby Dic is three feet long, and all its gear, except for cameras, is electronic. It has been tested up to half a mile from oceanographic-research vessel Sea Quest, and has relayed vital information on whale behavior.

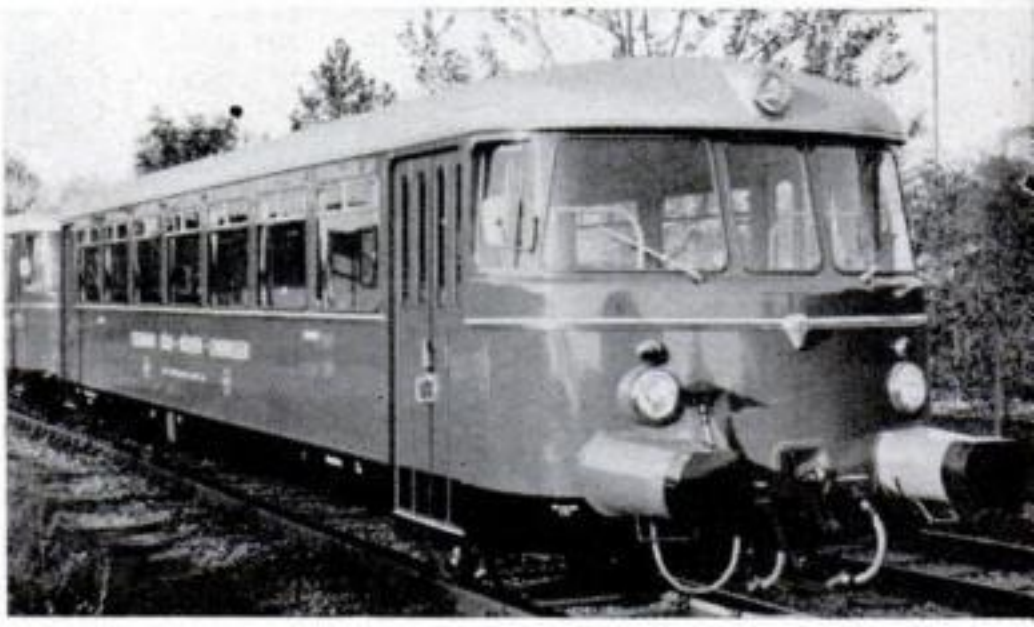
Robot Moby Dic to eavesdrop on other whales





Police freeway cruiser

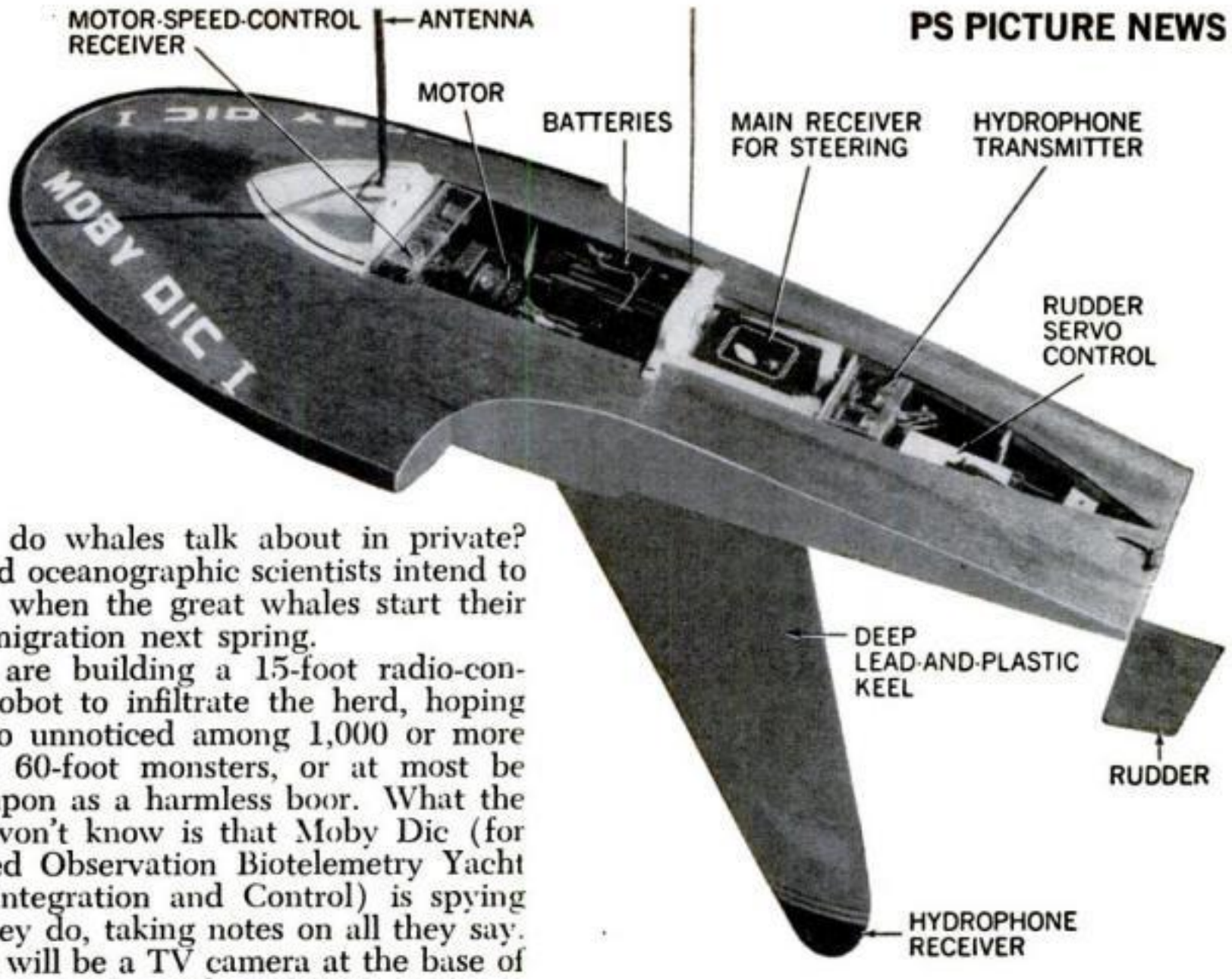
Special safety equipment has been fitted to six 1963 Oldsmobile Highway Patrol Apprehenders for Los Angeles police. Installations include a cage-type roll bar of two-inch pipe outlining door openings, headrests to prevent neck injuries, and seat belts. The cars have heavy-duty chassis, brakes, and shocks, and 345-hp. engines.



Railroad cars of plastic foam

Duralumin sheets enclosing a core of polyurethane foam form the shell of these new railroad cars, cutting weight by 30 percent. The German Federal Railways is testing two four-car trains. The lighter cars may speed up schedules on some lines, and permit longer trains on others, without increasing power needs.

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What do whales talk about in private? Lockheed oceanographic scientists intend to find out when the great whales start their annual migration next spring.

They are building a 15-foot radio-controlled robot to infiltrate the herd, hoping it will go unnoticed among 1,000 or more 40- and 60-foot monsters, or at most be looked upon as a harmless boor. What the whales won't know is that Moby Dic (for Motorized Observation Biotelemetry Yacht —Data Integration and Control) is spying on all they do, taking notes on all they say.

There will be a TV camera at the base of an antenna, and another camera, a movie monitor, and hydrophones on its keel. A mother ship for control and data recording will be about two miles away.

Nothing will then be sacred, not even private conversations between Mr. and Mrs. Whale as they discuss family problems. Scientists even hope that some day their intrusion will make it possible for them to make their own suggestions—and in the couple's own language.

Parachutists jump hand-in-hand

For several thousand feet of free fall, Air Force instructors hold the hand of parachute trainees until they learn by practice the art of pulling the ripcord. Then they float close by, shouting directions on control and proper landing techniques.

The training is designed to help young pilots learn how to avoid tumbling and disorientation, prevent injury, and steer clear of a bad landing area.



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Caught in a rain of stone and fire and deafened by concussion, men on ships nearby believed

THE DAY THE EARTH BLEW UP

Eighty years ago this month, the small volcanic isle of Krakatoa erupted, killing 36,000 in history's greatest natural explosion

By Don MacClure

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the Day of Judgment had come. Four hours later, the explosions were heard 3,000 miles away.

FROM the bridge of the Charles Bal after sunset, the strange cloud in the distance looked like a blood-red curtain with chains of fire leaping skyward and huge balls of white fire shooting out of it.

The ship was passing through Sunda Strait between Java and Sumatra on the night of Aug. 26, 1883, and her skipper, Capt. Harry Watson, was worried. "The concussions are deafening," he wrote in his log. "The volcano on Krakatoa is shaped like a pine tree brilliantly illuminated by electric flashes. The sea is covered with innumerable fish, floating belly-up."

There were several other ships near Captain Watson's Java-bound vessel. Their captains, too, were entering in their logs awed versions of what they saw and heard on the night when the earth tried to blow itself up.

"I am writing this blind, in pitch darkness," reads the log of the Northam Castle (Capt. Joshua Stone). "We are under a continual rain of pumice stone

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The actual blast killed no one; but catastrophe

and dust. So violent are the explosions that the ear-drums of over half my crew have been shattered. My last thoughts are with my dear wife. I am convinced that the Day of Judgment has come."

CAPTAIN Stone was wrong about the Day of Judgment, but millions of people in many parts of the world must have shared his gloomy prediction. The explosions he described were so tremendous that they were heard 3,000 miles away on the Island of Rodriguez in the Indian Ocean. James Wallsi, police chief there, referred in a report to "the distant roar of heavy guns from eastward."

He learned later that the sound waves had been traveling four hours before they reached him.

The eruption of Krakatoa caused some of the most destructive sound waves, gales, and sea waves ever known. Buildings and trees were flattened at Batavia, 100 miles away, and violent air vibrations traveled several times around the earth. The immense mass of material hurled into the sea caused a giant wave to rush onto the land at 400 miles an hour. Hundreds of coastal towns on the surrounding land masses were devastated. Lighthouses were swept away. A census two months later revealed that 36,380 people were drowned.

The red-hot debris from the blast covered an area larger than France. Only one-third of the original island land mass remained above sea level after the explosion, and where there had been three mountains a hole was left in the ocean bed 1,000 feet deep and six miles across.

KRAKATOA Island was about 18 square miles in size, roughly rectangular in shape, with three mountains—Rakata, 2,620 feet; Danan, 1,400 feet; and Perboewatan, 1,200 feet. Sunda Strait in which it lay connects the Indian Ocean with the North Pacific.

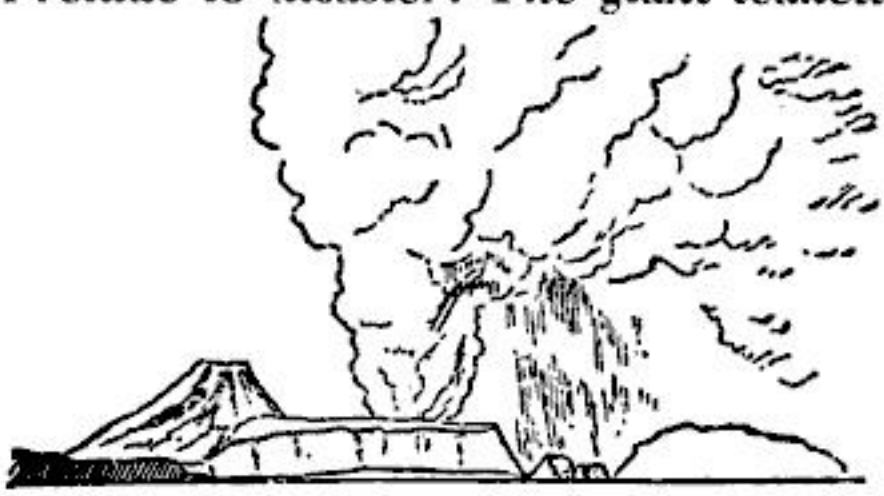
Krakatoa, along with Lang Island and Verlaten Island, was the remains of an ancient volcano, which was probably about 10,000 feet high in prehistoric times and had a crater about 25 miles in circumference. For more than 200 years the island had rested from its volcanic labors.

Then, in 1880, came warnings—tremors and rumblings felt as far off as Darwin, Australia. On May 20, 1883, the preliminary eruption began, caused by nothing more mysterious than the old-fashioned force that rattles the lid of a teakettle. But the fire under this kettle was a mile-long pocket of seething lava, and it changed a cubic mile of ocean into seering explosive steam.

On May 27, a group of Dutchmen from Batavia (now known as Jakarta) visited the island. The whole area was covered with white dust, while from the summit of the Danan crater a column of water vapor rose 10,000 feet high.

Several of them climbed up the side of Danan, stood on its edge, and noted with scientific thoroughness that there was a loud explosion every 5 to 10 minutes from a center hole in the crater.

Prelude to disaster: The giant teakettle rattles its lid

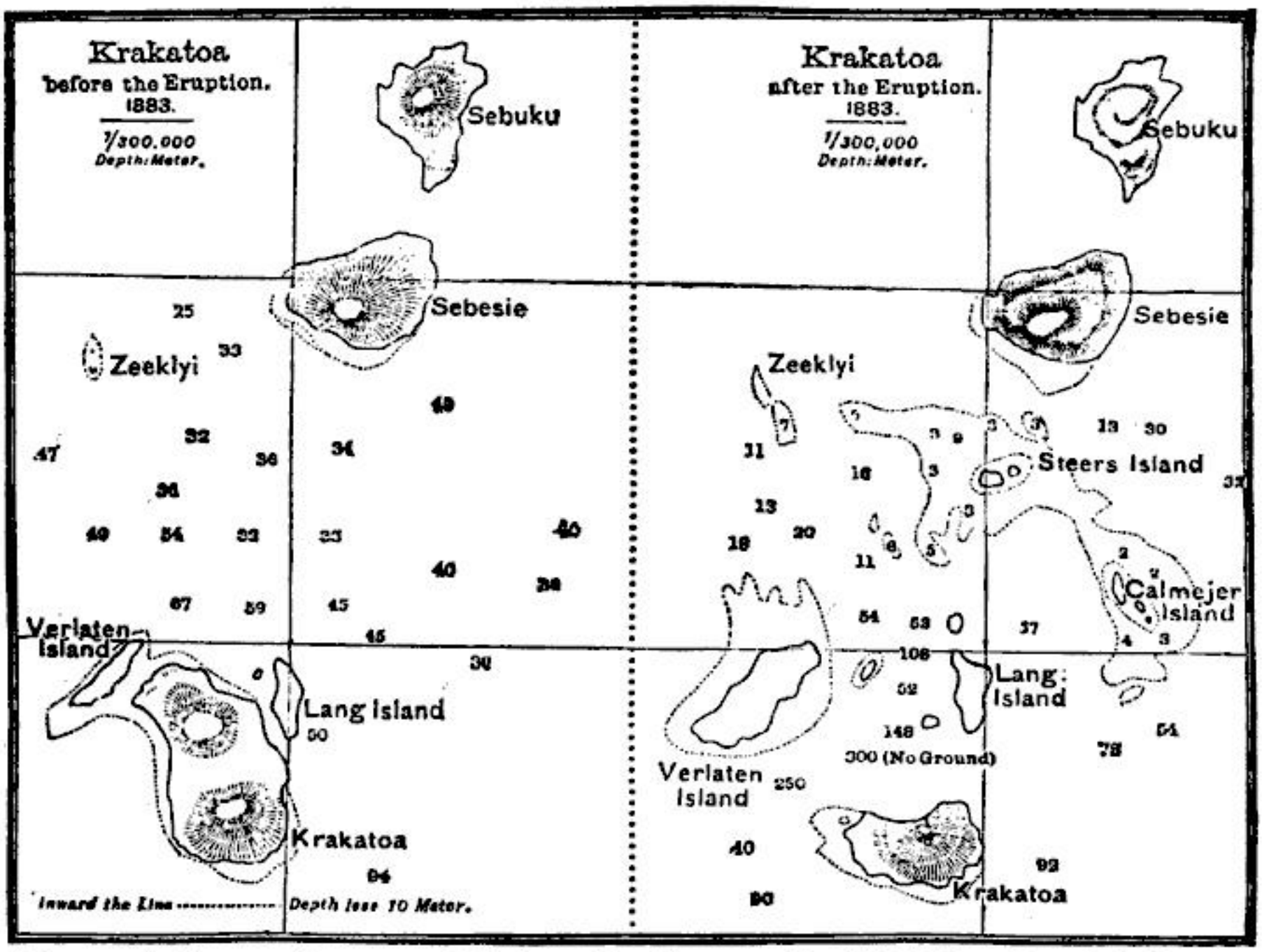


In May, three months before the big blast, Krakatoa began to rumble and belch forth lava. A column of water vapor rose 10,000 feet into the air. Sketches show how this earlier eruption changed island's profile.



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came with the 50-foot tidal wave that followed



Before and after: northern part of Krakatoa has disappeared, while Verlaten has tripled in area.

Each explosion uncovered boiling lava and shot pumice high into the air. Some pieces were as big as footballs.

One man fired a rifle six feet behind his companions during one of the explosions. Nobody heard the shot. It was completely drowned out.

THROUGH June, July, and August, Krakatoa rumbled and belched. On Aug. 26 and 27, it blew up.

A stream of white-hot lava burst forth with a deafening roar. The sides of the Danan crater abruptly caved in. Seconds later, the ocean rushed into the opening, and the water changed violently into superheated steam. Huge blocks of granite and obsidian rocketed upward in a cloud of dust and smoke. Again the ocean rushed in and exploded into steam, to break down barrier after barrier of rock.

How many times the boiling lava pushed back the ocean is not known, but in the end the ocean won. Early on Aug. 27, 1883, it inundated the volcanic center of the island, and the fury of the previous explosions was dwarfed by new sound effects.

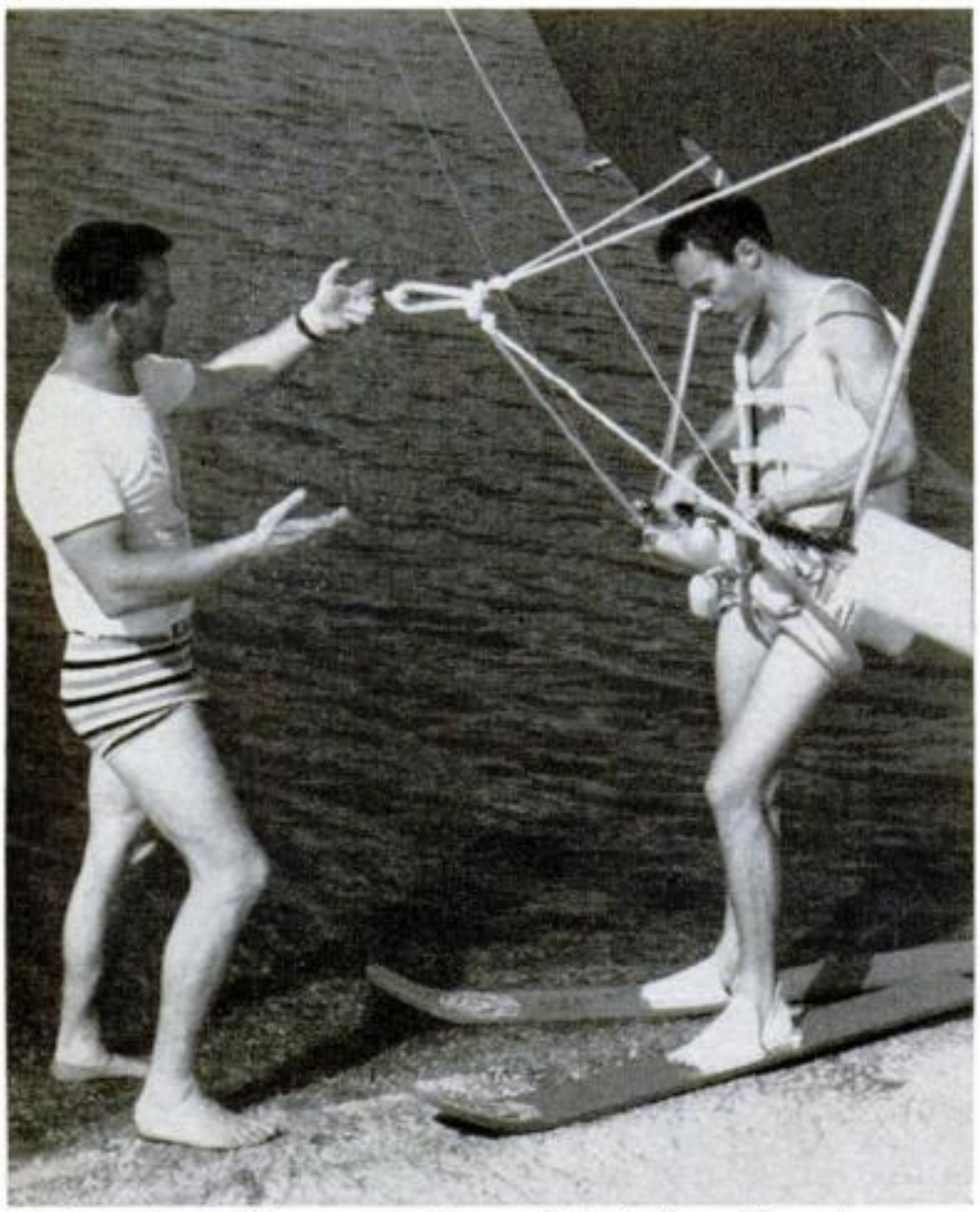
The cataclysm of energy and sound that was released was described as "the father of all sounds" by survivors in Batavia. For more than 36,000 people, it was the sound of doom, announcing the violent end of their world. It was one of the loudest noises ever to fall on the ears of man. As far away as Borneo —1,150 miles from Krakatoa—the sound triggered riots in a prison. The convicts thought ships were shelling the town.

KRAKATOA Island was uninhabited; the blast killed no one. The destruc-

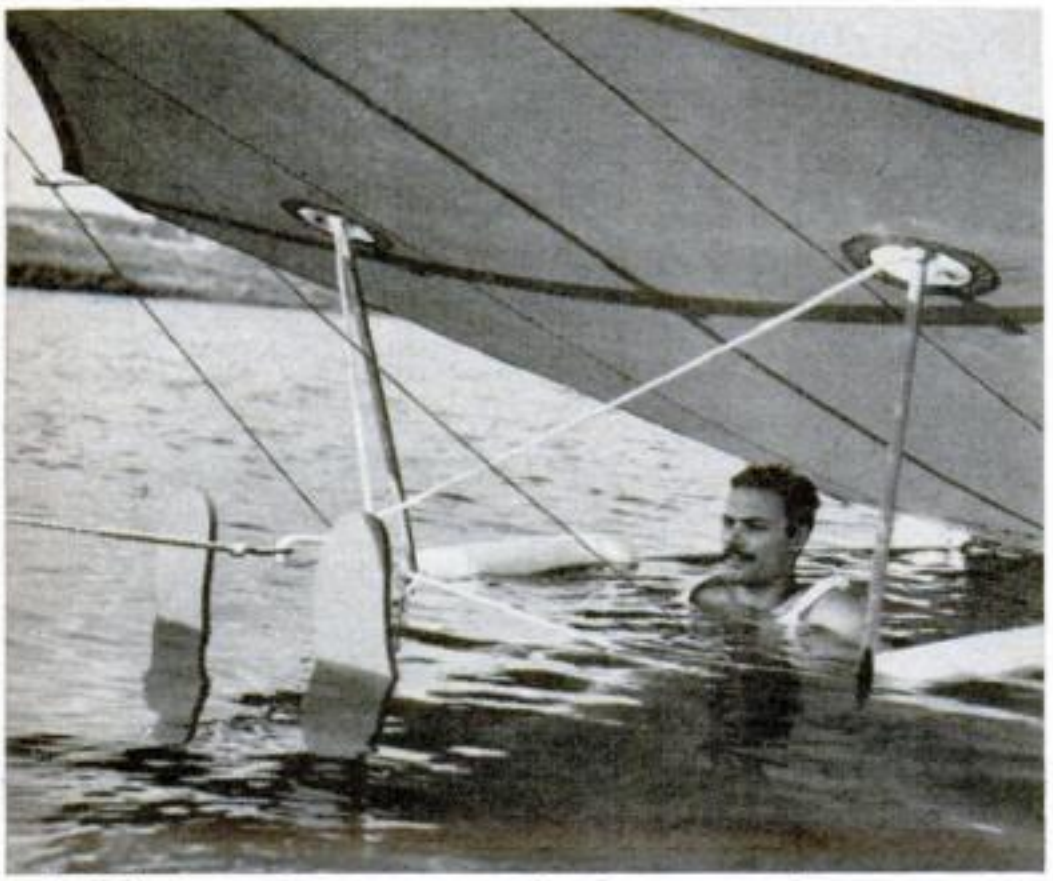
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Who Says Flying Is for the



Before I could protest I was life-jacketed and strapped into a girdle-like harness.



I bobbed in the water with ski tips poking out. As the tow rope tightened I was lifted upright—skiing.

By Robert Gannon

IN THE first place I didn't know how to water-ski. In the second, I've never piloted a plane or been much of a kite flyer. Nevertheless a few weeks ago I was dangling from a kite 75 feet up, whisking at 35 m.p.h. over Florida's Crooked Lake.

The ski-kite looks like an overgrown High Flyer with struts below. It's pulled by a boat, and it's called *ski*-kite because you wear water skis for takeoff.

I first saw the thing at Florida's Cypress Gardens. Afterward I urged performer Johnny Roberts and show director Simon Khoury to let me try. No go. Too dangerous, they said.

But later I talked with 33-year-old Ken Tibado, former Cypress Gardens star and the man who first water-skied barefoot without stubbing his toe. He has his own kite factory in Lake Wales, Fla. (kite prices run from $235 to $310, depending on size and fabric) and he, not surprisingly, advocates that *everyone* fly.

Though the idea of flying on a kite is old, few attempts were successful until 1954, when Tibado was preparing for a ski-jump exhibition. To gain more distance, he put together a five-foot sail and tied it to the tow-rope handle. The thing worked too well; he didn't come down until the boat slowed. The idea grew, and so did the kite.

But the Gardens people had discouraged me. "They must be talking about the old model," Tibado said. "That *was* dangerous on windy days. But the new design is absolutely sound, with pretested stress strengths of 500 pounds."

At Crooked Lake, Ken unpacked the rig, snapped it together, and

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Birds?

before I could protest, had me life-jacketed and strapped into a girdle-like harness. "Keep the kite level by swinging your body," he said. "Don't touch your emergency release unless you run into trouble."

Twin 100-hp. outboards came to life and the tow rope tightened. I was pulled forward, water burbling from the ski tips. My legs strained and I fought to keep the kite from wobbling above.

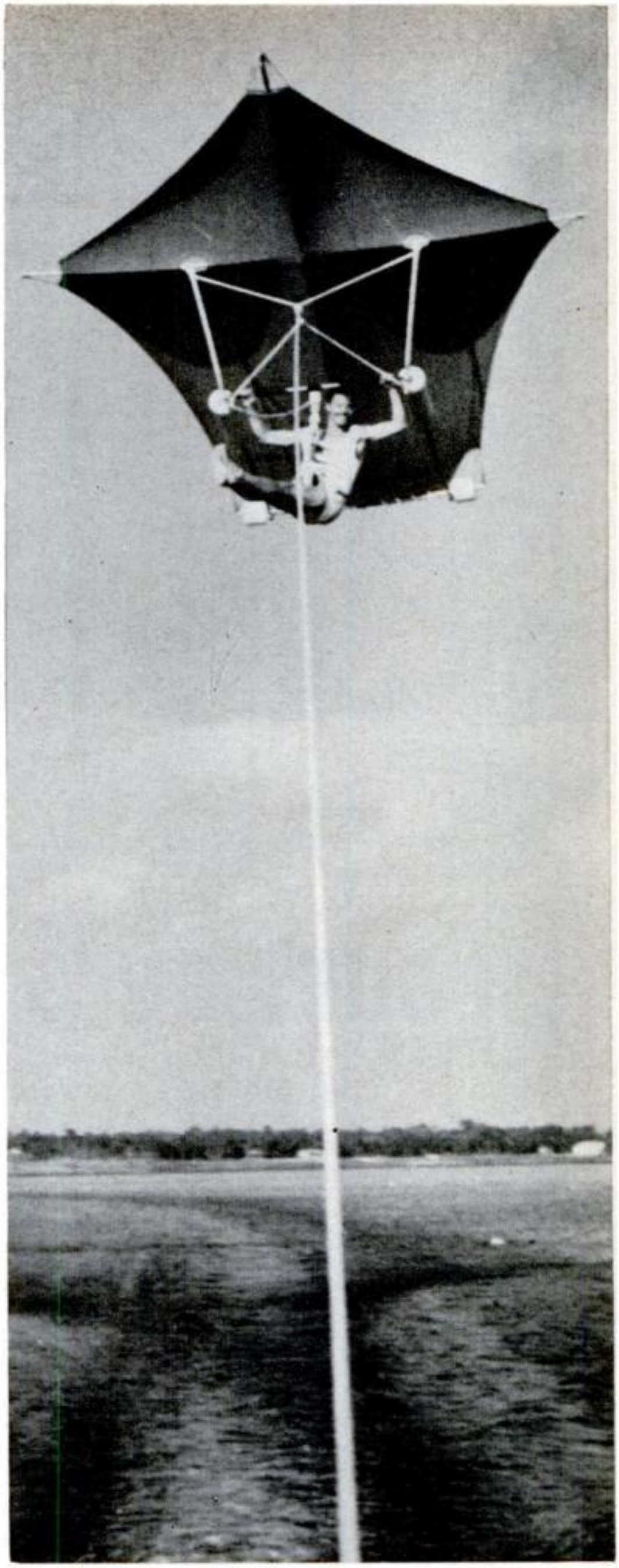
Suddenly I lifted upright, skiing. Ahead I heard the outboards change to a fast, high whine. The kite strained upward, my legs straightened, and I was airborne, 5 feet, 20, 50, 75 feet above the water. Far below—it seemed like a half-mile—the faces in the boat grinned up. I, too, was grinning like a half-wit.

A gust of side wind tilted the kite at an angle, and smooth as a toboggan I slid sideways down the air. Steer by leaning, Tibado had said, so I pulled my body weight to the up side of the holding bar. The kite leveled, skittered a bit, then shot up (too fast, too high).

I shifted and zoomed across again, getting the feel. But this time I leaned too much. The kite tilted crazily, and the water rushed up. Frantically I leaned in the other direction; the kite pulled out —as my skis dropped off.

Control was easier now, for I could swing my legs unencumbered. Gleefully I swooped and dived, occasionally skimming the water close.

The ending was dramatic. The boat slowed to about 25 m.p.h., the kite descended, and just as I touched the water, Tibado loosed the tow rope. I belly-flopped and got a snootful—then, supported by the kite's Styrofoam flotation, bobbed and waited. Fun.



Control was easy now for I could swing my legs free. I swooped and dived, grinning like a half-wit.

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Moment of decision: At T minus five, all systems are go. The Test Conductor turns

Four Hours in a Titan II

PS Exclusive: The minute-by-minute countdown of a missile that doubles as ICBM and space booster for Gemini astronauts

By Wallace Cloud

IT IS 11:35 a.m. I am making these notes in the blockhouse of Complex 15 at Canaveral. Outside on the launch pad, gripped by the many levels of its service structure, stands a 102-foot-high, 150-ton Titan II, an advanced Air Force ICBM, fueled and ready for the launch countdown.

This will be the second "blue-suit" firing of a Titan II—a test firing by an all-Air Force crew of 130 men. I am one of the few reporters ever permitted to witness a countdown from inside the blockhouse, the first to observe a Titan II countdown.

I was not allowed to bring my camera, and I have been warned that I will be locked in for at least four hours. I managed to smuggle in a sandwich.

My place of confinement is the glassed-in VIP booth at one side of the operations room. With me are observers from the Air Force and NASA—which will use the Titan II to place the two-man Gemini capsule in orbit—and from the Martin Company, builder of the Titans.

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to the committee table for permission to launch. He gets it—a hearty handshake.

Blockhouse

Earlier this morning, an Air Force press escort drove me through the gates of Cape Canaveral and handed me over to Maj. A. A. Catalano, a chunky man with black, curly hair and a bulldog manner. He is chief of the project branch of the 6555th Aerospace Test Wing.

As we went in past the 18-inch-thick steel inner door of the blockhouse, a mournful-sounding horn began hooting and men came hurrying out.

The earth-filled, concrete blockhouse dome was six feet thick—"We think it can withstand a direct hit if the missile should drop back on the pad and explode," Major Catalano said.

11:45. The squawk box in the VIP booth just said: "We will pick up the count in five minutes." The bird is scheduled to lift off at three p.m.

Looking out through the windows of the booth I can count 57 men—Air Force crewmen in white coveralls or khaki uniforms, and civilian technical advisers. They're gathered around three rows of dark-blue consoles, facing six television monitors. There's a duplicate row of TV screens in the VIP booth. Three submarine-type periscopes come down through the rough concrete dome.

The men at each console monitor a specific system in the missile or on the pad, or link the blockhouse with other control centers at Cape Canaveral.

At dead center, the Test Conductor sits at his console, flanked by aides. He is Maj. Harold T. Blackburn, a tanned, smiling officer with a shock of straight brown hair over his forehead.

Behind him is a table at which four men sit—a committee that makes the

CONTINUED

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Go or no go? As the clock runs backward, black

final decision to launch: Major Catalano, Major F. M. Hutchison (the Test Controller), and two civilian advisers.

11:49. "We will pick up the count in one minute." That's the countdown announcer. He proclaims 30 seconds, then "15 seconds . . . 10 seconds . . . 5 seconds . . . T minus 130 minutes—mark! T minus 130 minutes and counting." Neon-tube numbers in a box over the window of the VIP booth, which have been reading -130:00 for some time, begin blinking off seconds.

It is now 11:50, 3 hours and 10 minutes before scheduled T-zero—not 2 hours and 10 minutes, as the count would seem to indicate. The countdown contains a built-in hold of one hour, a cushion to permit the firing to take place within its schedule even should minor problems arise.

In the first few minutes, there's no action on the TV monitors, and I hear a series of cryptic exchanges on the intercom. The squawk box in the VIP booth is patched into Channel 2 of the MOPS (missile operations) intercom system, the Test Conductor's channel. Each of the 20 channels is a network for a separate phase of the countdown.

At T minus 113, I see a flurry of activity on one of the TV screens as a number of men leave the test stand.

T minus 112. The Test Conductor says: "TC to Pad Control. You are cleared to commence electrical connections." Another station breaks in with a request to send two men to a location on the pad. All such movements must be cleared with Pad Control—a man in a white suit moving about at the base of the launch stand, dwarfed by the missile.

T minus 105. One of the TV monitors shows three white-suited men connecting heavy electrical cables from the umbilical tower to the side of the missile—the arming cables. The bird, loaded with fuel and oxidizer last night, is now almost alive. Now the Test Conductor orders pressure and temperature checks of the missile's fuel and oxidizer tanks.

T minus 100. "All personnel report inside the blockhouse immediately."

It's time for the "safe-arm check"—a test of connections inside the bird to make sure the destruct detonators are properly armed. If not, the destruct system may start, blowing the glisten-

Clearing the way for flight, erector that lifted missile into position folds back down. Light shows through rectangular flame ports at base of second stage.

boxes have veto power

ing bird to smithereens on the stand.

But Pad Control interjects: "Request permission to delay safe-arm check. Estimate 8 to 10 more minutes of work."

TC tells him to bring the men in now and go back later to complete the work. Pad Control says, "Okay, will bring them out as soon as possible." This is not an argument, just a reminder that everything is done calmly during the countdown; unnecessary pressure on any man might result in an unsuccessful shot.

At T minus 95 I hear: "TC from Pad Control. We are leaving the pad now, will finish item 4 later."

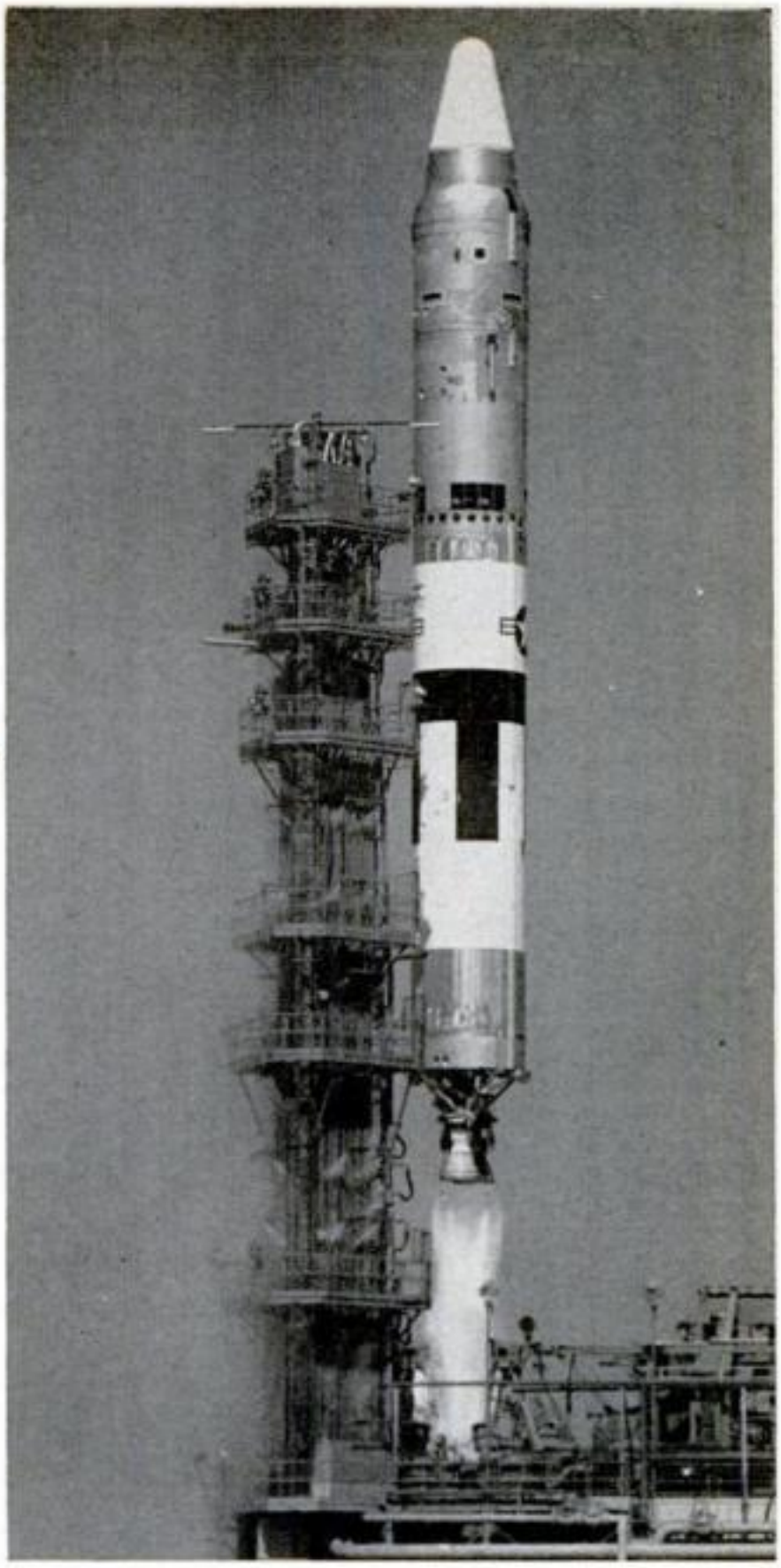
During the safe-arm check, the atmosphere in the blockhouse seems casual. Trailing long, coiled cords from their headsets, the men chat amiably, but each is keeping an eye on his indicator lights, listening to the stylized conversation on his MOPS channel.

I remark that they are like musicians in a big recording session, following the score without seeming to, ready to join in at the right bar of music. A Martin man next to me agrees: "It's the New York Philharmonic less instruments."

The blockhouse is the focus of the countdown—but at Cape Canaveral's Central Control building, the Air Force's Supervisor of Range Operations is monitoring island stations and tracking ships and planes downrange across the South Atlantic, and the Range Safety Officer is ready to flip the destruct switch if necessary. A few miles away, General Electric's guidance men are waiting to track the nose cone's radar beacons and determine its impact zone.

During the final minutes, both the Supervisor of Range Operations and the Range Safety Officer must agree with the Test Controller that all systems are in order. Their decision-making power is shared with a congress of black boxes that tell them whether each system is go or no go—and that also have the power to veto this flight.

T minus 88. The safe-arm check completed, the countdown continues on schedule. The TV screens show men climbing back onto the test stand. In one close-up, three men are preparing to check the propellant-tank emergency vents. They wear protective white splash suits and gas masks connected to emergency air packs.



Liftoff at T-zero. Missile N-21, 13th Titan II launched, heads for impact point some 6,300 miles downrange.

T minus 55. Another TV monitor shows platforms high on the test stand folding up, hydraulically actuated, to leave one side of the missile free.

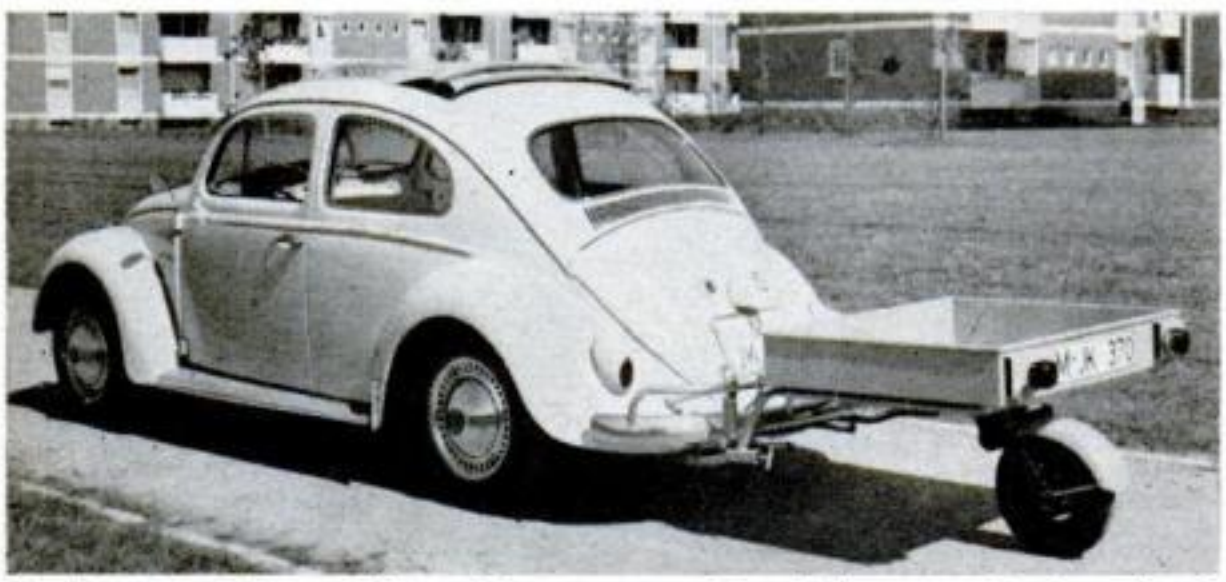
T minus 39:39. Pad Control reports that all men have left the platforms and

[Continued on page 160]

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Empty trailer gets lift piggyback on rear of Volkswagen above.



Back on roadway, it's a luggage carrier riding on single wheel.

Trailer rides piggyback when not hauling load

Need more luggage room in one of those small foreign cars? A Swiss manufacturer has come up with one solution: a tiny trailer that hauls up to 220 pounds in tow, rides piggyback when empty.

Transition from towing position to piggyback is made by removing the single wheel and swiveling the frame around on its hitch to where it can be secured on the back. The wheel then bolts to the trailer bed. Price in Europe is $125 to $225.



1. Katagote swivels up and down freely, adds little more than 20 pounds to scooter's weight.



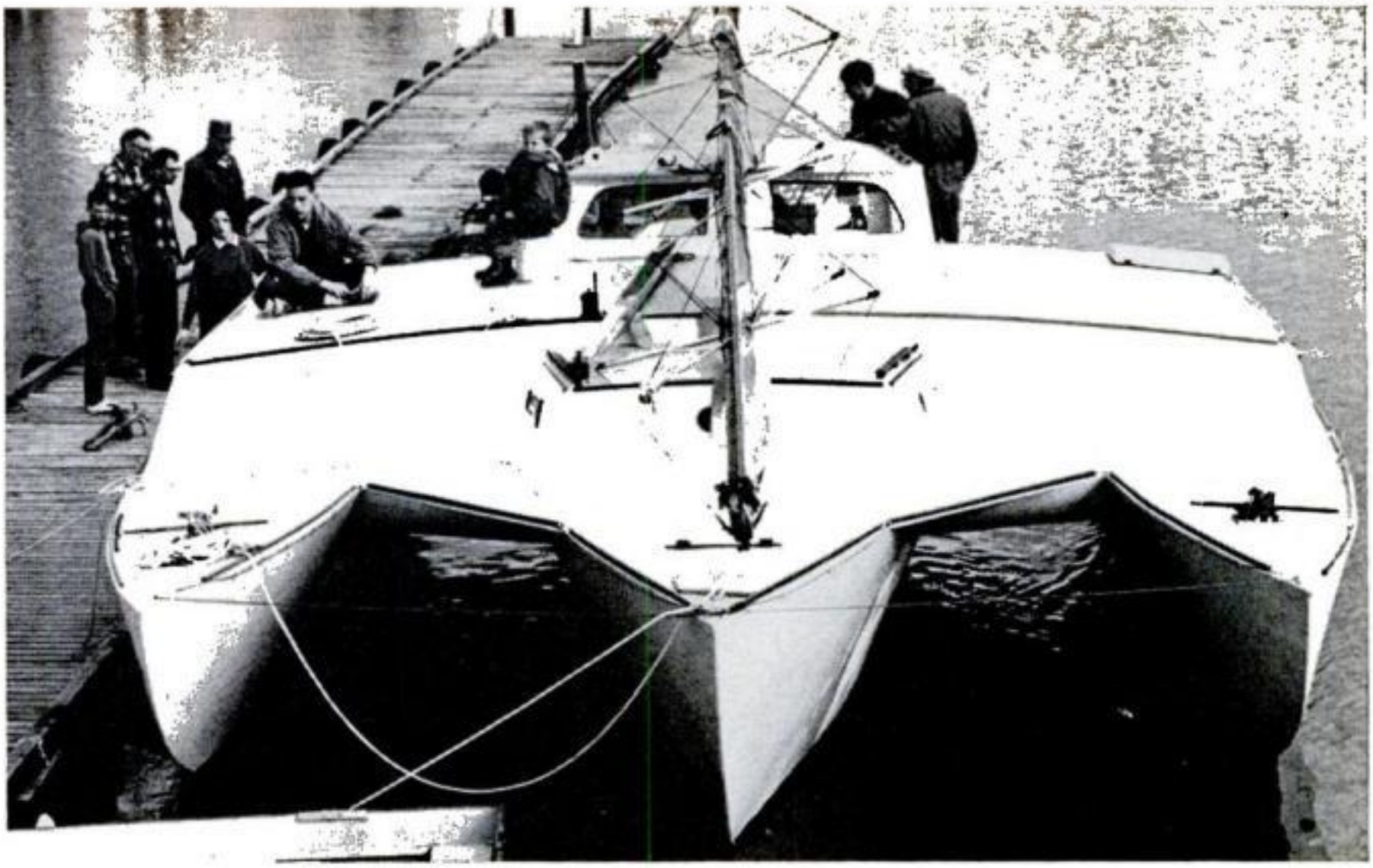
2. Extra traction of third wheel and track lets Tote Gote zip through mud and loose sand.

Go-anywhere scooter wheel

A trail cycle, built for blazing the way over rough ground, becomes even more of a trail breaker when fitted with a third wheel —one with tracks that takes it over otherwise impassable obstacles. Katagote is an attachment consisting of an extra wheel and tire, a tubular metal connector, and an 83-inch track. Two types of tread design are available: knobby or traction bar.

The trail-breaking rig sells as a kit and weighs a little over 20 pounds. It fits many models of such popular scooters

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Ocean-going trimaran

This 40-foot triple-hulled boat, launched on the Willamette River at Corvallis, Ore., was designed to cross the Pacific, sail the South Seas to the Marquesas Islands. Built for Mr. and Mrs. Walter Fredericksen, University of Oregon anthropology teachers, the craft can carry 540 feet of sail and has a 25-hp. auxiliary outboard.



3. Side Kick crosses shallow streams—important for hunters and campers on trips in woods.



4. It even climbs over large obstacles such as logs and rocks. Wheel spin is eliminated.

as the Side Kick, Tote Gote, Pack Mule, and Blayer. It can also be custom-fitted to almost any scooter if the dimensions and clearance are given: clearance from rear wheel to drive chain; clearance from front of rear wheel to nearest cross member, fender, or other part of frame; location and type of kickstand; distance from rear axle to aft frame; and inside frame measurement at rear axle.

A Katagote-equipped scooter is said to be able to drag a 20-foot log. Lee F. Griffith, 1825 N. Holman, Portland, Ore., sells the kits for $97.50

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The Fine Art of FAST DRIVING

Speed with safety —that's what this fast-driving course run by the British School of Motoring teaches. Want to get just a "little bit extra" from your hot car? Come for a ride

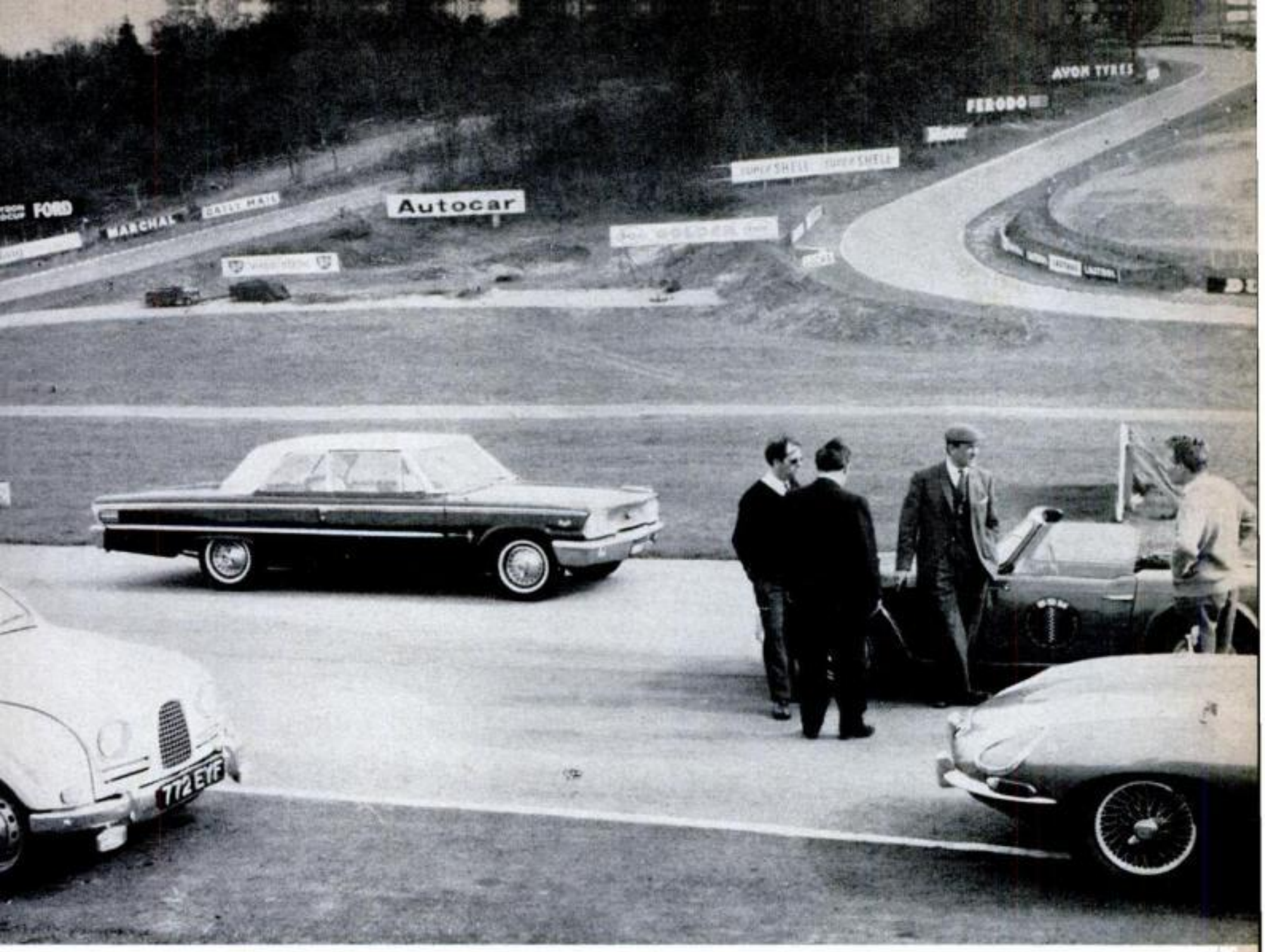
By David Scott
PS European Editor





Track is British, but author Scott "went to school" in Ford Galaxie to get idea of how Detroit cars can be driven fast but safely in U.S.

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Instructor Miles (back to camera) takes breather with fellow teachers at Brands Hatch closed-circuit track. Saab, TR-4, and E-type Jag simulated opposing traffic for Ford Galaxie.

I'VE just spent two days at the world's first school for fast drivers. It's for guys like me (or you) who think they already know how to drive, but don't balk at postgraduate lessons from experts. If you're buying a hot car and want to get the full kicks out of it—safely—this is for you.

My tutor was ex-police sergeant John Miles, chief instructor for the High-Performance Course run by the British School of Motoring. My classroom was a Ford Galaxie 500/XL. I wanted to find out how the school would teach me to handle a powerful American job.

It was loaded: T-Bird 390-inch 300-hp. engine, Cruise-O-Matic transmission, power brakes and steering. Put your foot down in this, and the car you're passing shrinks in the mirror like a pricked balloon.

We spent the first day at Brands Hatch race track, 20 miles southeast of London, for intensive drill in cornering. This twisty circuit is a popular arena for weekend racing spectacles, from Grand Prix to club events.

Top drivers like Stirling Moss, Jack Brabham, and Phil Hill have drifted around its bends. World Champion Graham Hill had his first racing lesson at Brands while he was still a mechanic.

But racing is out when the school takes over. Then the 1¼-mile C-shaped circuit is used like an ordinary winding road, but without the hazards of a public one. "We teach you how to go fast with knowledge and safety—how to wield power without being corrupted by it," Miles began as he started the Ford off on a couple of slow warmup laps.

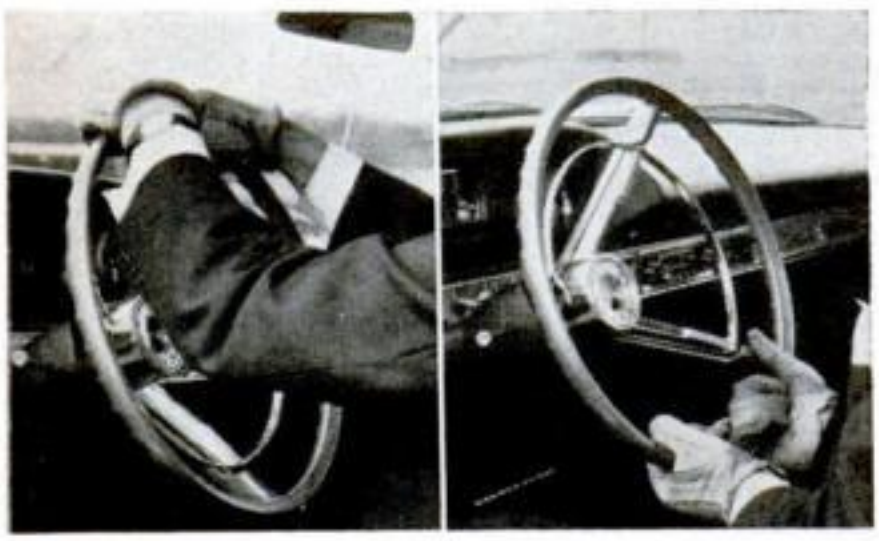
"Steering comes first. Watch my

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Hands on wheel at a quarter-to-three and light grip, especially with power steering, to retain road feel are recommended by Miles.



For full control and to avoid "running out of hands" on corners, start with both hands on top of wheel. For left turn, grip with left hand and pull wheel down half a turn, sliding relaxed right hand down around rim to meet left. Then release left hand, grip with right, and push up.

hands." He was holding the wheel at a quarter-to-three. "Make it a feather-light grip," he said, "especially with power assistance like this. Turn the wheel just with the weight of your hands."

A relaxed hold prevents tensing and fidgety weaving on straights, and helps keep a smooth arc through bends. It also gives you some "feel," telling you what the nose of the car is trying to do before it does it.

Grip and slide. A sharp left-hand corner came up. Miles moved his hands to the top of the wheel. As we entered the bend he pulled both hands down until they met at the bottom of the wheel. He explained: "I gripped with the left and slid the right along the rim." To complete the revolution he switched holds, pushing up with his right hand while the left mirrored the movement. Leaving the bend, he unwound the same way.

This is the wheel-shuffling taught by the British police, who scorn hand-crossing. After 17 years of handling a patrol car and seven more instructing at the Metropolitan Police Driving School in London, Miles is sold on this method. "It's fast and sure," he says, "and you don't run out of hands."

The car picked up speed as we ran through several laps. "Now for fast cornering," said Miles. "It's a science. Basic rule is 'in slow and out fast on the correct line.'

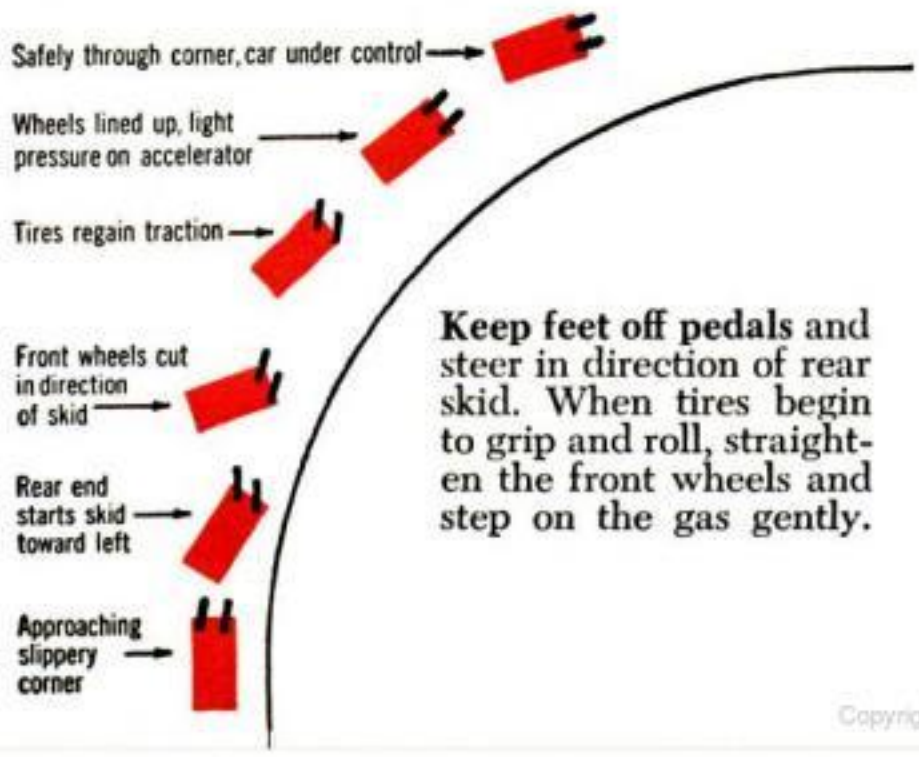
"We assume the track to be a four-lane undivided highway with no obstructing traffic on our side," he told me, heading for a right turn. (The American Ford called the tune for one day at the keep-to-the-left English circuit, and we drove to the right.) "Now get this!"

The turns. On the approaching straight, Miles swung into the left lane. At the start of the bend he steered into an arc that cut across the corner. The car heeled over on its springs. "Take it easy!" I muttered, clutching the seat nervously. But in a moment we were neatly lined up in the right lane of the outgoing straight.

"It's simple geometry," Miles grinned. "Draw that line with a compass on paper and you'll see that it's a flatter curve with a longer radius than even the center line of the road. And it's a shorter route. You can take it faster, and it's an easier path to steer."

Miles piled on more reasons as we shot rock-steady out of the corner. "You get an earlier view around the bend of oncoming traffic and any hidden obstacle on the road. The car is straighter much

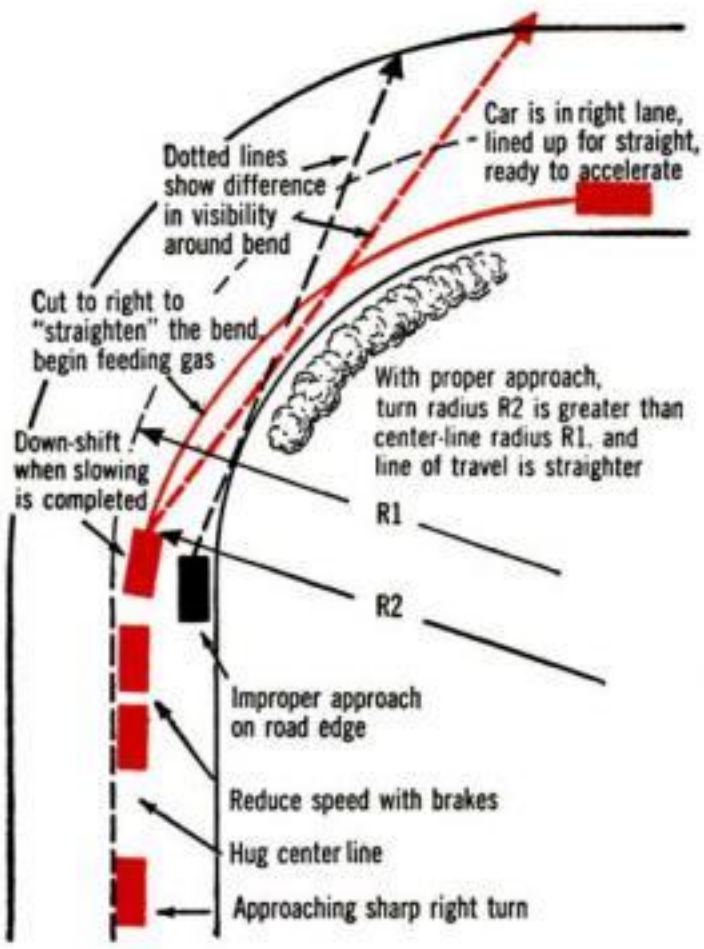
Retaining control in a skid



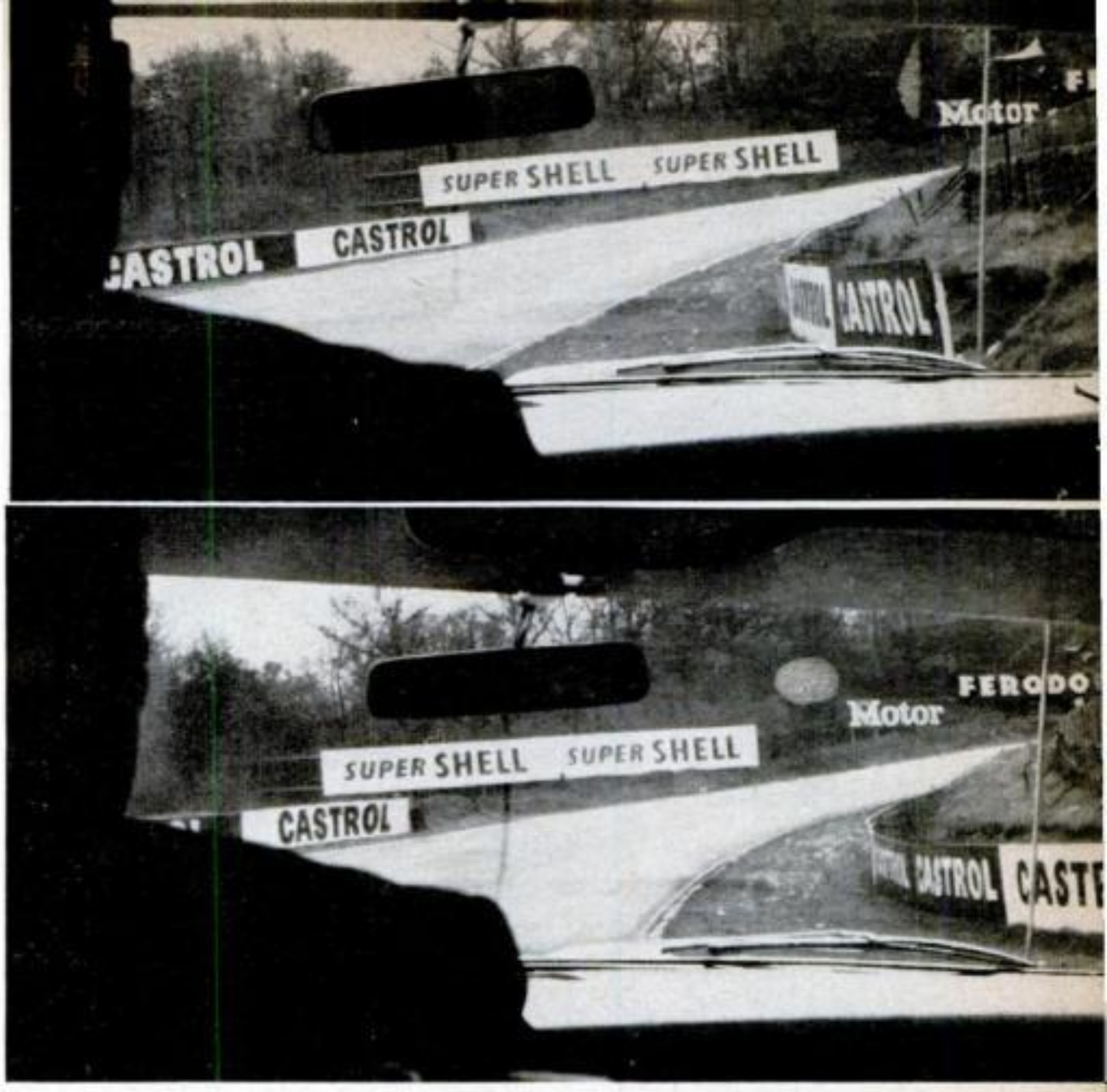
Keep feet off pedals and steer in direction of rear skid. When tires begin to grip and roll, straighten the front wheels and step on the gas gently.

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The fastest line through a corner is also the safest



Best line for right turn is flat arc running from near road center to right lane; this increases the radius of the turn.



How to approach a right-hand corner: Car at top is incorrectly hugging edge of road, still pointed straight (note line of antenna). Visibility around bend is poor. Car at bottom is well out toward center, already headed into curve. Visibility around bend is better.

earlier, so you can accelerate sooner."

On the tight left turn that followed he reversed the pattern. He hugged the edge of the road until about the apex of the curve, then sliced across both lanes to end up just inside the center.

"Fact is," he continued, "a car just isn't interested in turning corners. The manufacturer designs it to go straight with front-wheel caster action. On a bend you have to come to terms with momentum and centrifugal force."

We were doing about 70 when the next curve rushed towards us. "Hold tight," chuckled Miles. "I'll take this one a bit faster." As he squeezed the throttle he rattled off the think-talk commentary required of police student-drivers and now taught on the High-Performance Course.

"Speed 80—right-hander ahead—move toward center line—ease on brakes—70-60-50—shift down—holding steady 50—steer into turn—gentle curved line aimed for right lane—bit more throttle—nearly around—give it gas—accelerate to 80—shift up . . ."

Now I was more at ease. "Why don't you down-shift first?" I asked.

"Don't like engine braking for corners," he replied. "Take off most of the speed with your brakes, then shift."

This puts the car in a "balanced" neutral state, and helps to prevent entering a curve too fast. Control is more precise with the engine pulling steadily, not decelerating, at the start of a turn.

Shifting an automatic. Some automatics give you no choice; with little engine braking, the car virtually coasts on the over-run. With our three-speed Cruise-O-Matic we would drop to second below 80 m.p.h. by flicking the sport-stick on the central console to "L." This acts like a kickdown without gunning the engine, and drag through the torque converter slows the wheels.

"Do you see how I use this transmis-

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Swinging into left-hand turn, Miles holds Ford close to edge until apex to be certain no road hog is approaching. Then he'll slice diagonally to left, close to center, to line up for straight.

sion like a manual gearbox?" Miles demanded. He shifted just before entering the turn, after braking almost to the cornering speed. Easing the throttle down a hair through the curve, he stamped on it for the getaway, then returned to "D."

"Got it all?" he asked. We stopped, and I slid behind the wheel.

I muffed the first few corners. On one I slammed in too fast, shifted late, and was forced into the sin of braking on a bend. The tires howled.

Next I misjudged the sweep of a sharp turn, ran wide, and had to twitch the wheel at midpoint to keep off the shoulder. "Two bites at a corner upsets your balance," Miles said calmly. "Set your course at the beginning and hold it."

After several laps I began to catch on. The beauty of a workout on a closed circuit is that you can make repeated runs through the same corners, practicing the approach until you get them perfect.

For variety we turned around and burned up the track in the other direction, where every corner presented a different aspect.

"Notice what your eyes are doing?" Miles broke in. I did, now that he mentioned it. At speeds of 70 and 80 I was unconsciously focusing farther ahead.

"That's natural," said Miles. "But you must think farther ahead, too. When you get there, your visual target will lose its details as it flashes by. You have to plan in advance the whole time."

I saw what he meant. Concentrating hard as I zoomed into the next curve, I found myself braking, shifting, and steering according to thought-messages formed a few seconds earlier.

Skid control. To teach skid technique, the school built an unusual skid pan near the track. It's an S-shaped section of road with turn-around loops at each end, and paved with troweled-on mastic asphalt for a glassy finish.

When flooded with water the surface is so slick that sliding tires wipe it dry like a squeegee. Bends have a reverse camber just to make things tougher.

Practice car is an old Morris 1000 doctored up with bald tires in back. I had a crack at this deadly combination, which can simulate a 50-m.p.h. skid at a safer 20. The little car spun across the road at the first turn of the wheel. Clinging to a corner was about as easy as standing on a cake of soap in the bathtub.

Miles grinned. "Rule number one: steer into the skid. Number two: keep your feet off the pedals. Get her rolling! That's the first thing. With the usual tail-end breakaway you want to swing the nose of the car directly in front of the rear. Don't declutch, brake, or accelerate. And don't panic. The moment the tires regain their grip, wind off the steering correction. When all four wheels are lined up—not before—just touch the throttle.

"Always remember," Miles cautioned, "you can't drive yourself out of a skid."

He took over to demonstrate. As he guided the Morris into a right-hand corner the rear slithered out like a hockey puck on ice. "Watch this," he snapped. He spun the wheel to the left. His foot hovered over the gas pedal.

The front swung around promptly. "We're rolling again." But the car was headed across the road. Instantly Miles unwound the wheel to straighten out, then gingerly toed the accelerator.

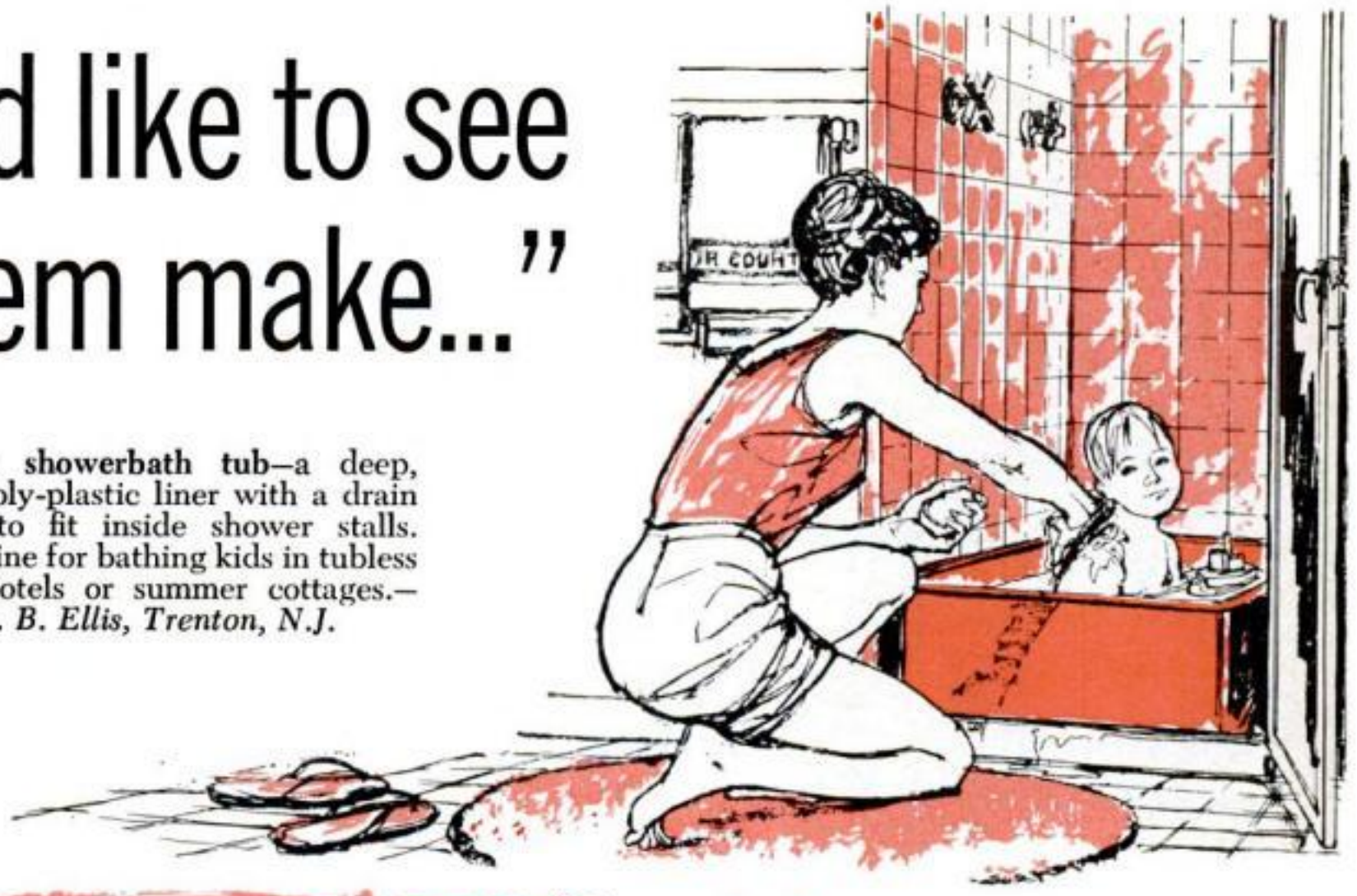
It was split-second timing, with the seat of his pants flashing the signals.

To prevent skids, he stressed, take the

[*Continued on page 154*]

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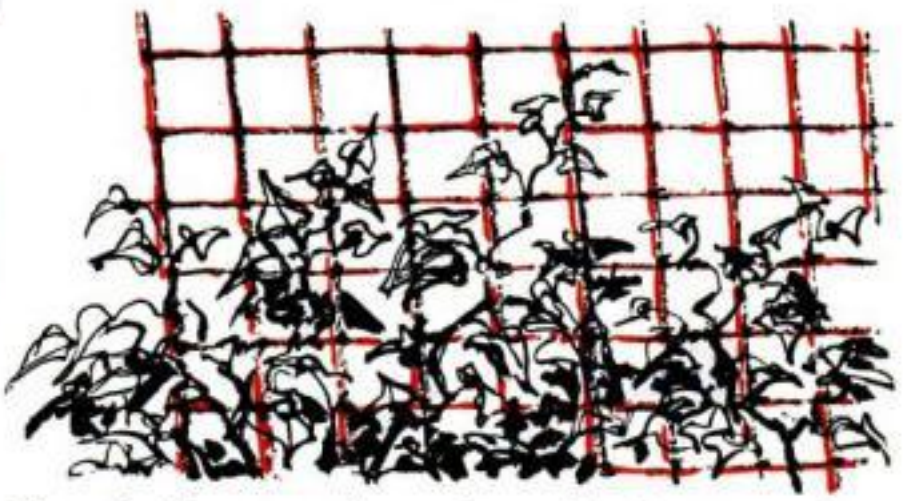
"I'd like to see them make..."



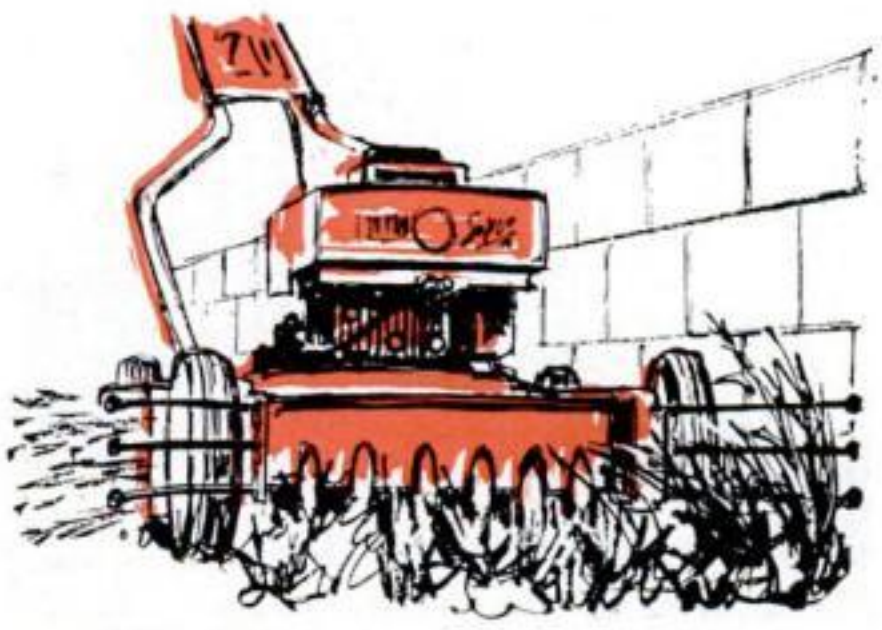
A showerbath tub—a deep, poly-plastic liner with a drain—to fit inside shower stalls. Fine for bathing kids in tubless motels or summer cottages.—*T. B. Ellis, Trenton, N.J.*



Underwater spotlights on skin-diving masks. A working light like a miner's lamp would be out of the way where it wouldn't impede the diver.—*K. H. Schroeder, Westmont, N.J.*



Chemically treated netting, dyed green, for supporting vegetable vines. At the end of the season, it could be thrown on the compost pile to aid decomposition.—*G. Jorgensen, Tacoma.*



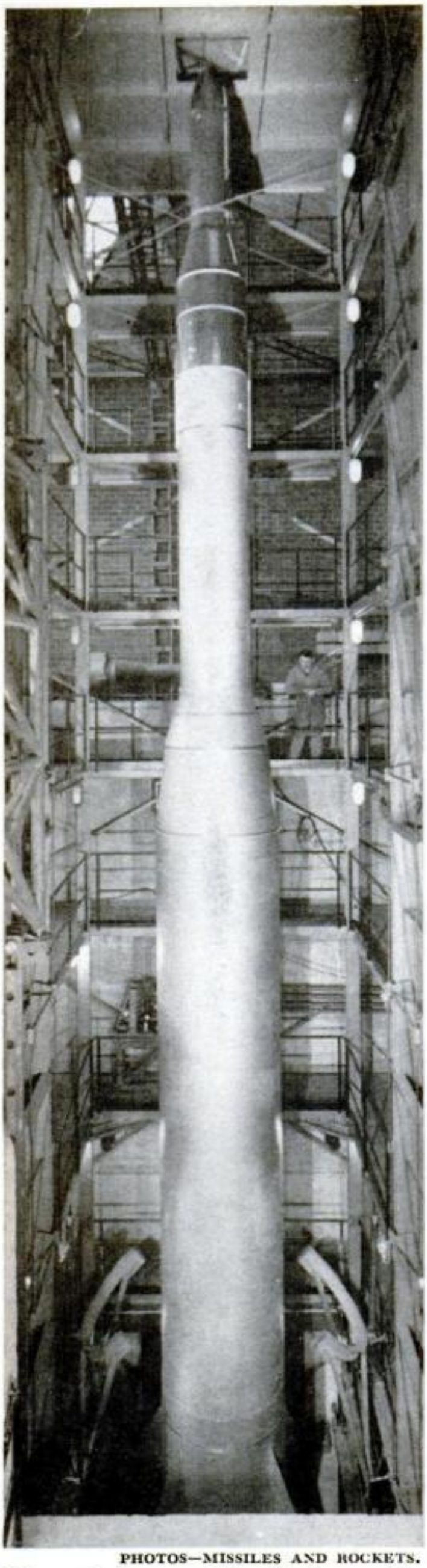
Extendable fingers at sides of power mowers. Tall grass close to the house or garden beds would be guided into the path of the blade.—*Dr. L. A. Russell, Newtonville, Mass.*



Baby carseats designed for a small sports-car bucket seat—or better still, to fit between the two seats, saddled over the hump.—*Mrs. Carol G. Donahue, W. Andover, Mass.*

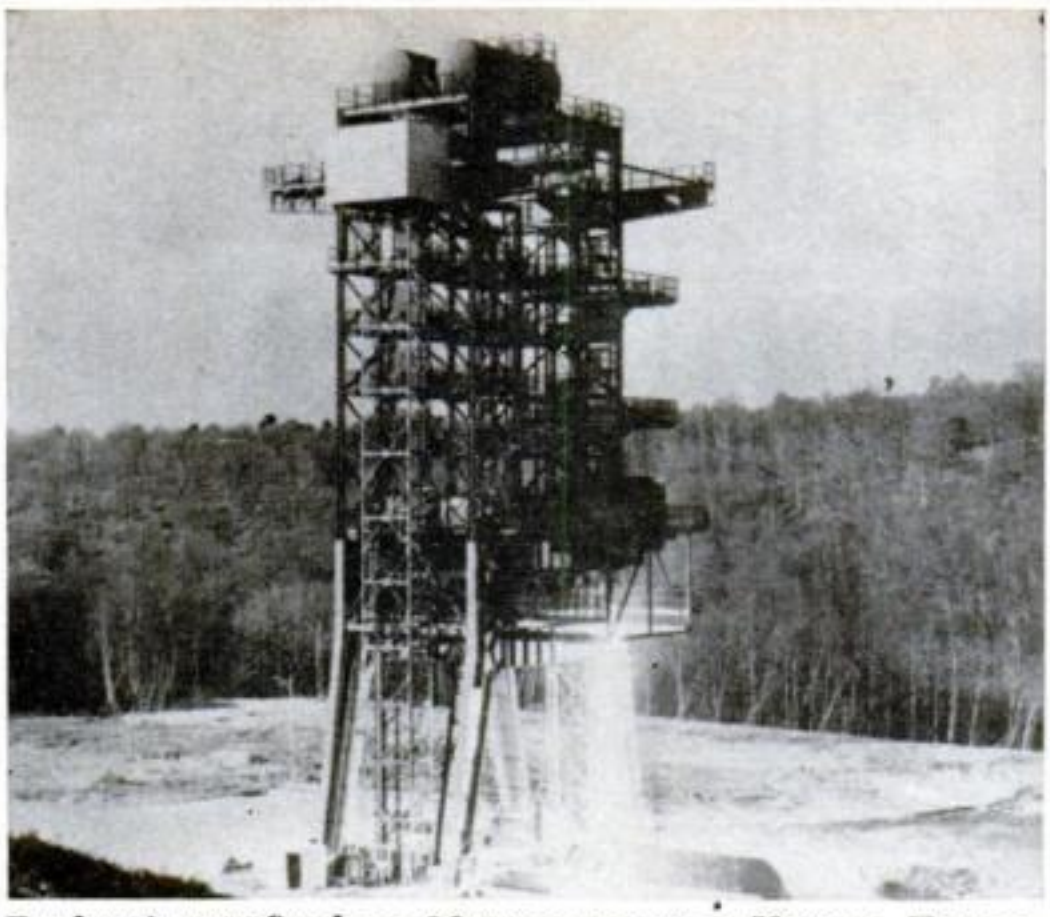
Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.

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PHOTOS—MISSILES AND ROCKETS.

Diamant, shown getting final assembly touches, will have liquid-fueled first stage, solid-fueled upper stages.

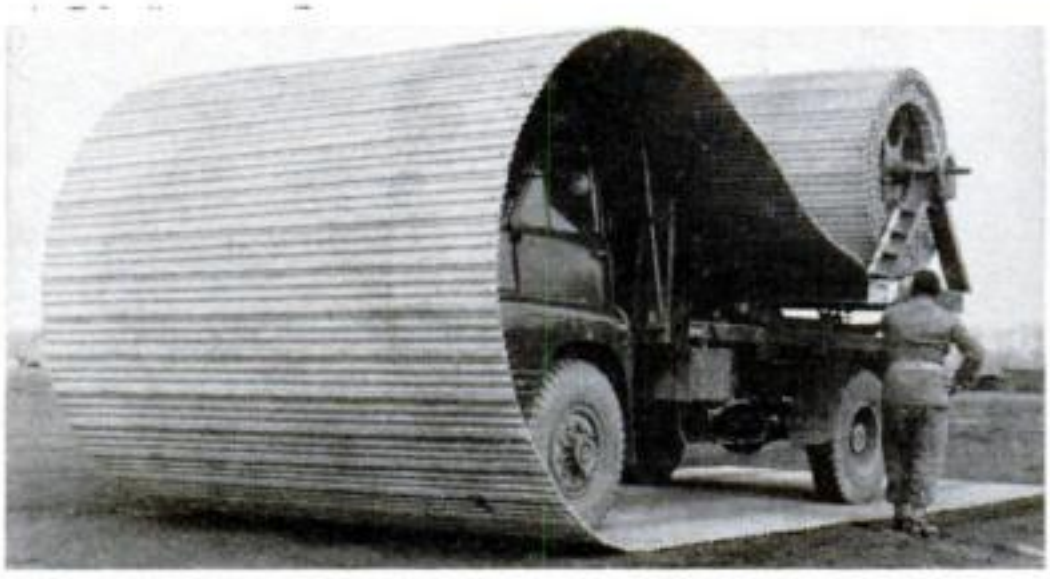


Rocket is test-fired on 10-story tower at Vernon, France.

French get into space act

France's first rocket designed to launch a satellite was shown this summer at the Paris Air Show. The French space agency—*Centre National d'Etudes Spatiales*—expects the Diamant to put France into orbit in 1964. The rocket is 66 feet long, half a foot longer than the USAF Boeing Minuteman, five feet shorter than NASA's Chance Vought Scout, which has been used in the past by the U.S. to boost satellites into orbit for Britain and other nations.

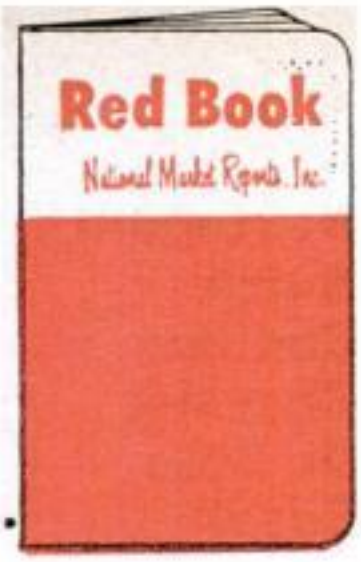
Britain is working on its own booster, the Blue Streak, for a European satellite—a multilateral effort of the West European countries.



Flexible roadway laid by truck

A British army truck lays its own road to provide a firm track on soft ground for vehicles that follow it. Coiled around a spindle on a trunnion-mounted detachable frame at the back, a corrugated ribbon is fed over the cab and tucked under the front wheels to unwind as the truck moves. The driver is guided by the strip's edge. He can put down a 55-yard coil in 11 seconds.

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Latest average retail values of Checker, Chevrolet, Dodge, Mercury, Oldsmobile, Rambler, and Studebaker, 1963 to 1958, compiled exclusively for Popular Science by Red Book, published by National Market Reports, Inc. (Others next month.)

WHAT'S your car worth today? Or what should you have to pay for that clean '61 you've been thinking about? Less than when you last checked? Where did you get your information? From newspaper ads—or from what a dealer said

WHAT'S YOUR CAR WORTH TODAY?

he would allow on a trade-in? You need something more reliable than that before you trade for a new car or shop for a used one.

Sure, you can study the ads and get a rough idea of what your car is selling for on used-car lots. And it will be rough—both the figure you get and the time you spend on the lots comparing cars and prices. Dealers don't get their information that way; why should you?

For more than 50 years the bible of the industry for used-car values has been *Red Book Official Used Car Valuations.* It is sold on subscription to dealers, banks, and insurance companies. It is not readily available to the average car owner. When a dealer talks about the "book value" of your car, this is almost always the book he's referring to.

Now—for the first time ever by any magazine—POPULAR SCIENCE publishes the average retail values of U. S. used cars, 1963-1958. These were compiled *exclusively* for POPULAR SCIENCE by *Red Book*, published by National Market Reports, Inc., and are based on a thorough study of the current used-car market. POPULAR SCIENCE offers them in August, the peak period of "clean-up" trading before the 1964s make used cars of all the 1963s.

Remember: These are retail averages—what the cars are selling

CONTINUED

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for on used-car lots. What a dealer might allow for your car on a trade is something else again. Let's say your '61 is valued at $1,500. If the new car you're buying is a stripped-down economy model, a dealer will probably allow you about $1,150 (wholesale value; what he could get if he sold it at auction). If you're buying a deluxe job with extras, the dealer may allow you $1,500 and take his profit from the new car and his markup on accessories.

Whether the dealer gives you a "discount" or allows you "more" for your trade-in doesn't matter. What counts is the cash *difference*. So if the window sticker on the new car totals $3,400 and the dealer says he'll take "your car and $1,900," you know he's allowing $1,500, the full retail value of your '61. You can take it from there.

Next month:
Buick
Cadillac
Chrysler
De Soto
Edsel
Ford
Thunderbird
Imperial
Lincoln
Plymouth
Pontiac

REGIONAL VARIATIONS

Add 4% to retail values listed below if you live in one of the following states: Alabama, Arkansas, Colorado, Florida, Georgia, Iowa, Kansas, Louisiana, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Wyoming.

Add 7% to retail values listed below if you live in: Arizona, California, Idaho, Nevada, Oregon, Utah, Washington.

AVERAGE RETAIL VALUES

The Average Retail Value of a car represents its retail value *including* radio and heater. AUTOMATIC TRANSMISSION VALUES ARE INCLUDED ON ALL EIGHT CYLINDER MODELS ONLY AND MUST BE ADDED FOR ALL SIXES. The values as shown represent the value of an average car.

OPTIONAL EQUIPMENT

Optional equipment values appear at the end of each model year listing.

Model	Body Type	Avg Retail
CHECKER		
Automatic Trans. Not Included		
1962-6		
CHECKER SUPERBA		
	Sed 4dr-6	1600
	Wag 4dr-8	1785
CHECKER MARATHON		
....	Sed 4dr-6	1680
....	Wag 4dr-8	1860
"Optional equipment" for 1962:		
	ADD-Power Brakes	25
	ADD-Power Strg.	50
	ADD-A-10 OHV Eng.	45
	ADD-Single Auto. Trans.	125
	ADD-Dual Range Trans.	150
1961-6		
CHECKER SUPERBA		
....	Sed 4dr-6	1300
....	Wag 4dr-6	1470
CHECKER MARATHON		
....	Sed 4dr-6	1350
....	Wag 4dr-6	1515
"Optional equipment" for 1961:		
	ADD-Power Brakes	20
	ADD-Power Strg.	45
	ADD-A-10 OHV Eng.	25
	ADD-Single Auto Tr.	95
	ADD-Dual Range Tr.	125
1960-6		
SUPERBA STANDARD		
....	Sed 4dr-6	1050
....	Sta Wag 4dr-6	1150
SUPERBA SPECIAL		
....	Sed 4dr-6	1095
....	Sta Wag 4dr-6	1200
"Optional equipment" for 1960 Checker:		
	ADD-Power Brakes	15
	ADD-Power Strg.	30
	ADD-A10 OHV Eng.	15
	DEDUCT-Std. Trans.	65
	ADD-Dual Range Trans.	75
CHEVROLET		
Auto. Trans. Included (Exc. 6 Cyl.)		
1963-6		
CORVAIR 500		
0527	Cpe Club 2dr-5	1850
CORVAIR 700		
0769	Sed 4dr-6	1950
0727	Cpe Club 2dr-5	1900
CORVAIR MONZA 900		
0969	Sed 4dr-5	2200
0927	Cpe Club 2dr-4	2250
0967	Conv 2dr-4	2325
R1206	Spt Wag 6dr-6	2475
1963-4 CHEVY II		
CHEVY II "100"		
0169	Sed 4dr-6	1900
0111	Sed 2dr-6	1850
0135	Wag 4dr-6	2125
CHEVY II "300"		
0369	Sed 4dr-6	1950
0311	Sed 2dr-6	1900
0345	Wag 4dr-9	2175
1963-6 CHEVY II		
CHEVY II "100"		
0269	Sed 4dr-6	1950
0211	Sed 2dr-6	1900
0235	Wag 4dr-6	2175
CHEVY II "300"		
0469	Sed 4dr-6	2000
0411	Sed 2dr-6	1950
0445	Wag 4dr-9	2225
CHEVY II NOVA		
0449	Sed 4dr-6	2050
0437	Cpe Spt 2dr-5	2075
0467	Conv 2dr-5	2250
0435	Wag 4dr-6	2275
1963-6		
BISCAYNE SERIES 1100		
1169	Sed 4dr-6	2225
1111	Sed 2dr-6	2175
1135	Wag 4dr-6	2525
BEL AIR-SERIES 1500		
1569	Sed 4dr-6	2325
1511	Sed 2dr-6	2275
1545	Wag 4dr-9	2700
1535	Wag 4dr-6	2625
IMPALA-SERIES 1700		
1769	Sed 4dr-6	2450
1739	H.T. 4dr-6	2575
1747	H.T. 2dr-5	2525
1767	Conv 2dr-5	2775
1745	Wag 4dr-9	2825
1735	Wag 4dr-6	2750
1963-8		
BISCAYNE-SERIES 1200		
1269	Sed 4dr-6	2450
1211	Sed 2dr-6	2400
1235	Wag 4dr-6	2750
BEL AIR-SERIES 1600		
1669	Sed 4dr-6	2550
1611	Sed 2dr-6	2500
1645	Wag 4dr-9	2925
1635	Wag 4dr-6	2850
IMPALA-SERIES 1800		
1869	Sed 4dr-6	2675
1839	H.T. 4dr-6	2800
1847	H.T. 2dr-6	2750
1867	Cpe Conv 2dr-5	3000
1845	Wag 4dr-9	3050
1835	Wag 4dr-6	2975
1963-8-CORVETTE		
0837	Cpe Spt 2dr-2	3850
0867	Conv 2dr-2	3700
"Optional equipment" on 1963 Chevrolet Series:		
	ADD-Power Brakes*	30
	ADD-Power Strg.*	65
	ADD-Optional Engines:	
	Turbo V-8 327	95
	Turbo V-8 409	240
	Fuel Inj. Corvette	400
	ADD-4 Sp. Trans. Corvair.	75
	ADD-4 Speed Trans.	170
	ADD-Overdrive	95
	ADD-Powerglide Trans:	
	Corvair	150
	Chevy II	150
	Chevrolet 6 cyl.	170
	DEDUCT-Std. Trans.	180
	8 cyls. only	
*Except Corvair		
1962-6		
1962-6-CORVAIR		
CORVAIR 500		
0527	Cpe Clb 2dr-5	1525
CORVAIR 700		
0769	Sed 4dr-6	1575
0727	Cpe Clb 2dr-5	1575
0735	Wag 4dr-6	1725
CORVAIR MONZA 900		
0969	Sed 4dr-6	1800
0927	Cpe Clb 2dr-4	1825

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Model	Body Type	Avg Retail
0967	Conv 2dr-4	2000
0935	Wag 4dr-6	1975
CORVAIR MONZA SPYDER		
0969	Cpe Clb 2dr-4	2025
0967	Conv 2dr-4	2200
GREENBRIER '95'		
R1206	Wag 4dr-6	2025
1962-4-CHEVY II		
CHEVY II '100'		
0169	Sed 4dr-6	1575
0111	Sed 2dr-6	1550
0135	Wag 4dr-6	1750
CHEVY II '300'		
0369	Sed 4dr-6	1625
0311	Sed 2dr-6	1600
0345	Wag 4dr-9	1800
1962-6-CHEVY II		
CHEVY II '200'		
0269	Sed 4dr-6	1625
0211	Sed 2dr-6	1600
0235	Wag 4dr-6	1800
CHEVY II '300'		
0469	Sed 4dr-6	1675
0411	Sed 2dr-6	1650
0445	Wag 4dr-9	1850
CHEVY II NOVA '400'		
0449	Sed 4dr-6	1775
0441	Sed 2dr-6	1750
0437	Cpe Spt 2dr-5	1850
0467	Cpe Conv 2dr-5	1950
0435	Wag 4dr-6	1925
1962-6-CHEVROLET		
BISCAYNE-SERIES 1100		
1169	Sed 4dr-6	1675
1111	Sed 2dr-6	1650
1135	Wag 4dr-6	1875
BEL AIR-SERIES 1500		
1569	Sed 4dr-6	1775
1511	Sed 2dr-6	1750
1537	H.T. 2dr-5	1875
1545	Wag 4dr-9	2025
1535	Wag 4dr-6	1975
IMPALA-SERIES 1700		
1769	Sed 4dr-6	1975
1739	H.T. 4dr-6	2100
1747	H.T. 2dr-5	2100
1767	Cpe Conv 2dr-5	2200
1745	Wag 4dr-9	2125
1735	Wag 4dr-6	2075
1962-8-CHEVROLET		
BISCAYNE-SERIES 1200		
1269	Sed 4dr-6	1850
1211	Sed 2dr-6	1825
1235	Wag 4dr-6	2050
BEL AIR-SERIES 1600		
1669	Sed 4dr-6	1950
1611	Sed 2dr-6	1925
1637	H.T. 2dr-5	2050
1645	Wag 4dr-9	2200
1635	Wag 4dr-6	2150
IMPALA-SERIES 1800		
1869	Sed 4dr-6	2150
1839	H.T. 4dr-6	2275
1847	H.T. 2dr-5	2275
1867	Cpe Conv 2dr-5	2375
1845	Wag 4dr-9	2300
1835	Wag 4dr-6	2250
1962-8-CORVETTE		
0867	Cpe Conv 2dr-2	3225
"Optional equipment" for 1962:		
	ADD-Power Brakes	25
	ADD-Power Strg	50
	ADD-Optional Engines:	
	Turbo-Air 102 Corvair	25
	Turbo-Fire 250 V-8	45
	Turbo-Fire 300 V-8	80
	Turbo-Fire 380 V-8	190
	Fuel Inj. Corvette	375
	ADD-4 Sp. Tr. Corvair	45
	ADD-4-Speed Trans	120
	ADD-Overdrive	65
	ADD-Powerglide Trans.:	
	Corvair	95
	Chevy II	100
	Chevrolet 6 cyl	120
	DEDUCT-Std. Trans. 8 cyls. only	125
1961-6-CORVAIR		
SERIES 500		
569	Sed 4dr-6	1225
527	Cpe Clb 2dr-5	1225
535	Wag 4dr-6	1350
SERIES 700		
769	Sed 4dr-6	1275
727	Cpe Clb 2dr-5	1275
735	Wag 4dr-6	1400
MONZA-SERIES 900		
969	Sed 4dr-6	1525
927	Cpe Clb 2dr-4	1550
GREENBRIER-SERIES R1206		
R1206	Wag 6dr-6	1575
1961-6		
BISCAYNE FLEETMASTER		
SERIES 1300		
1369	Sed 4dr-6	1250
1311	Sed 2dr-6	1225
BISCAYNE-SERIES 1100		
1169	Sed 4dr-6	1325
1111	Sed 2dr-6	1300
1121	Utility 2dr-3	1225
BEL AIR-SERIES 1500		
1569	Sed 4dr-6	1400
1539	H.T. 4dr-6	1525
1511	Sed 2dr-6	1375
1537	H.T. 2dr-5	1525
IMPALA-SERIES 1700		
1769	Sed 4dr-6	1575
1739	H.T. 4dr-6	1700
1711	Sed 2dr-6	1550
1737	H.T. 2dr-5	1700
1767	Conv 2dr-5	1775
STATION WAGONS		
SERIES 1100		
1115	Brookwood 2dr-6	1575
1135	Brookwood 4dr-6	1525
SERIES 1500		
1545	Kingswood 4dr-9	1675
1535	Parkwood 4dr-6	1625
SERIES 1700		
1745	Nomad 4dr-9	1750
1735	Nomad 4dr-6	1700
1961-8		
BISCAYNE FLEETMASTER		
SERIES 1400		
1419	Sed 4dr-6	1400
1411	Sed 2dr-6	1375
BISCAYNE-SERIES 1200		
1219	Sed 4dr-6	1475
1211	Sed 2dr-6	1450
1221	Utility 2dr-3	1375
BEL AIR-SERIES 1600		
1619	Sed 4dr-6	1550
1639	H.T. 4dr-6	1675
1611	Sed 2dr-6	1525
1637	H.T. 2dr-6	1675
IMPALA-SERIES 1800		
1869	Sed 4dr-6	1725
1839	H.T. 4dr-6	1850
1811	Sed 2dr-6	1700
1837	H.T. 2dr-6	1850
1867	Conv 2dr-5	1925
STATION WAGONS		
SERIES 1200		
1245	Brookwood 4dr-9	1725
1235	Brookwood 4dr-6	1675
SERIES 1600		
1645	Kingswood 4dr-9	1825
1635	Parkwood 4dr-6	1775
SERIES 1800		
1845	Nomad 4dr-9	1900
1835	Nomad 4dr-6	1850
1961-8-CORVETTE		
SERIES 800		
867	Conv 2dr-2	2850
	ADD-H.T. Assy	125
"Optional equipment" for 1961:		
	ADD-Power Brakes*	20
	ADD-Power Strg.*	40
	ADD-230" V-8 Eng	20
	ADD-250" V-8 Eng	45
	ADD-280" V-8 Eng	50
	ADD-348" V-8 Eng	25
	ADD-Overdrive	45
	ADD-Fuel Inj. Corvette	315
	ADD-4 Sp. Trans	95
	ADD-Turboglide-ex. Corvette	115
	ADD-Powerglide	
	Corvair	75
	6-cyl. Chevrolet	95
	DEDUCT-Std. Trans. 8 cyls. only. *N.A. on Corvair & Corvette	95
1960-6-CORVAIR		
STANDARD SERIES 500		
0569	Sed 4dr-6	950
0527	Cpe Clb 2dr-6	925
DeLUXE SERIES 700		
0769	Sed 4dr-6	1000
0727	Cpe Clb 2dr-6	975
MONZA SERIES 900		
0927	Cpe Clb 2dr-6	1175
1960-6		
BISCAYNE-SERIES 1100		
1119	Sed 4dr-6	1025
1111	Sed 2dr-6	1000
1121	Utility 2dr-3	925
BISCAYNE FLEETMASTER-1300		
1319	Sed 4dr-6	975
1311	Sed 2dr-6	950
BEL AIR-SERIES 1500		
1519	Sed 4dr-6	1125
1539	Sed H.T. 4dr-6	1250
1511	Sed 2dr-6	1100
1537	Cpe H.T. 2dr-6	1250
IMPALA-SERIES 1700		
1719	Sed 4dr-6	1275
1739	Sed H.T. 4dr-6	1400
1737	Cpe H.T. 2dr-5	1400
1767	Cpe Conv 2dr-6	1425
STATION WAGONS		
BISCAYNE-SERIES 1100		
1135	Brookwood 4dr-6	1250
1115	Brookwood 2dr-6	1225
BEL AIR-SERIES 1500		
1545	Kingwood 4dr-9	1325
1535	Parkwood 4dr-6	1275
IMPALA-SERIES 1700		
1735	Nomad 4dr-6	1375
1960-8		
BISCAYNE SERIES 1200		
1219	Sed 4dr-6	1150
1211	Sed 2dr-6	1125
1221	Utility 2dr-3	1050
BISCAYNE FLEETMASTER-1400		
1419	Sed 4dr-6	1100
1411	Sed 2dr-6	1075
BEL AIR-SERIES 1600		
1619	Sed 4dr-6	1250
1639	Sed H.T. 4dr-6	1375
1611	Sed 2dr-6	1225
1637	Cpe H.T. 2dr-5	1375
IMPALA-SERIES 1800		
1819	Sed 4dr-6	1400
1839	Sed H.T. 4dr-6	1525
1837	Cpe H.T. 2dr-6	1525
1867	Cpe Conv 2dr-6	1550
STATION WAGONS		
BISCAYNE-SERIES 1200		
1235	Brookwood 4dr-6	1375
1215	Brookwood 2dr-6	1350
BEL AIR-SERIES 1600		
1645	Kingswood 4dr-9	1450
1635	Parkwood 4dr-6	1400
IMPALA-SERIES 1800		
1835	Nomad 4dr-6	1500
1960-8-CORVETTE		
SERIES 800		
867	Conv. 2dr-2	2375
	ADD-H.T. Assy	95
"Optional equipment" for 1960 Chevrolet:		
	ADD-Power Brakes N.A. Corvette	20
	ADD-Power Strg N.A. Corvette	30
	ADD-230" V-8 Eng	15
	ADD-245" V-8 Eng	65
	ADD-250" V-8 Eng	20
	ADD-270" V-8 Eng	75
	ADD-280" V-8 Eng	65
	ADD-320" V-8 Eng	75
	ADD-335" V-8 Eng	100
	ADD-Overdrive	30
	ADD-Fuel Inj. Corvette	150
	ADD-4 Sp. Trans	75
	ADD-Turboglide Over Powerglide	95
	ADD-Powerglide 6 Cyl. Exc. Corvair	75
	Corvair	65
	DEDUCT-Std. Trans. 8 Cyl. only	75
1959-6		
BISCAYNE-1100		
1119	Sed 4dr-6	800
1111	Sed 2dr-6	775
1121	Utility 2dr-3	675
BEL AIR-1500		
1519	Sed 4dr-6	850
1539	Sed H.T. 4dr-6	925
1511	Sed 2dr-6	825
IMPALA-1700		
1719	Sed 4dr-6	1000
1739	Sed H.T. 4dr-6	1075
1737	Cpe H.T. 2dr-6	1075
1767	Cpe Conv. 2dr-6	1150
STATION WAGONS		
1135	Brookwood 4dr-6	925
1115	Brookwood 2dr-6	900
1535	Parkwood 4dr-6	1000
1545	Kingwood 4dr-9	1025
1735	Nomad 4dr-6	1075
1959-8		
BISCAYNE-1200		
1219	Sed 4dr-6	900
1211	Sed 2dr-6	875
1221	Utility 2dr-3	775
BEL AIR-1600		
1619	Sed 4dr-6	950
1639	Sed H.T. 4dr-6	1025
1611	Sed 2dr-6	925
IMPALA-1800		
1819	Sed 4dr-6	1100
1839	Sed H.T. 4dr-6	1175
1837	Cpe H.T. 2dr-6	1175
1867	Cpe Conv 2dr-6	1250
STATION WAGONS		
1235	Brookwood 4dr-6	1025
1215	Brookwood 2dr-6	1000
1635	Parkwood 4dr-6	1100
1645	Kingwood 4dr-9	1125
1835	Nomad 4dr-6	1175
CORVETTE-800		
867	Conv. 2dr-2	1975
	ADD-H.T. Assy	80
"Optional equipment" for 1959 Chevrolet:		
	ADD-Power Brakes	15
	ADD-Power Strg	25
	ADD-Overdrive	25
	ADD-Fuel Injection	125
	ADD-348" V-8 Eng	15
	ADD-245 H.P. Eng. Corvette	15
	ADD-4 Sp. Trans	65
	ADD-Powerglide 6 Cyl. only	65
	ADD-Turboglide	75
	DEDUCT-For Std. Trans. 8 cyl. only	65
1958-6		
DELRAY-1100		
1149	Sed 4dr-6	525
1141	Sed 2dr-6	500
1121	Sed Util 2dr-3	450
BISCAYNE-1500		
1549	Sed 4dr-6	575
1541	Sed 2dr-6	550
BEL AIR-1700		
1749	Sed 4dr-6	650
1739	Sed H.T. 4dr-6	725
1741	Sed 2dr-6	625
1731	Cpe Spt. H.T.-6	725
1747	Spt Cpe Imp-5	800
1767	Conv Impala-5	800
STATION WAGONS		
1193	Yeoman 4dr-6	650
1191	Yeoman 2dr-6	625
1593	Brookwood 4dr-6	700
1594	Brookwood 4dr-9	725
1793	Nomad 4dr-6	750
1958-8		
DELRAY-1200		
1249	Sed 4dr-6	600
1241	Sed 2dr-6	575
1221	Sed Util 2dr-3	525

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Model	Body Type	Avg Retail
BISCAYNE-1600		
1649	Sed 4dr-6	650
1641	Sed 2dr-6	625
BEL AIR-1800		
1849	Sed 4dr-6	725
1839	Sed H.T. 4dr-6	800
1841	Sed 2dr-6	700
1831	Cpe Spt H.T.-6	800
1847	Spt Cpe Imp-5	875
1867	Conv Impala-5	875
STATION WAGONS		
1293	Yeoman 4dr-6	725
1291	Yeoman 2dr-6	700
1693	Brookwood 4dr-6	775
1694	Brookwood 4dr-9	800
1893	Nomad 4dr-6	825
CORVETTE		
867	Conv-2	1700
	ADD-H.T. Assy	65
"Optional equipment" for 1958 Chevrolet:		
	ADD-Power Brakes*	15
	ADD-Power Strg*	20
	ADD-348 Cu In Eng	15
	ADD-Overdrive*	20
	ADD-Powerglide 6 cyl. only	50
	ADD-Turboglide*	65
	ADD-Fuel Injection	95
	ADD-4 Sp. Trans.	45
	DEDUCT-Std. Trans. 8 cyl. only	50

*Not available on Corvette

DODGE

Auto. Trans. Included (Exc. 6 Cyl.)

Model	Body Type	Avg Retail
1963-6		
DART 170-TL1-L		
713	Sed 4dr-6	1900
711	Sed 2dr-6	1850
756	Wag 4dr-6	2125
DART 270-TL1-H		
733	Sed 4dr-6	1975
731	Sed 2dr-6	1925
735	Conv 2dr-6	2175
776	Wag 4dr-6	2225
DART GT-TL1-P		
742	H.T. 2dr-5	2100
745	Conv 2dr-6	2300
1963-6		
DODGE 330-TD1-L		
413	Sed 4dr-6	1975
411	Sed 2dr-6	1925
457	Wag 4dr-9	2300
456	Wag 4dr-6	2225
DODGE 440-TD1-M		
423	Sed 4dr-6	2075
421	Sed 2dr-6	2025
422	H.T. 2dr-6	2100
POLARA-TD1-H		
433	Sed 4dr-6	2225
432	H.T. 2dr-6	2275
1963-8		
DODGE 330-TD2-L		
613	Sed 4dr-6	2200
611	Sed 2dr-6	2150
657	Wag 4dr-9	2525
656	Wag 4dr-6	2450
DODGE 440 TD2-M		
623	Sed 4dr-6	2300
621	Sed 2dr-6	2250
622	H.T. 2dr-6	2350
667	Wag 4dr-9	2625
666	Wag 4dr-6	2550
POLARA-TD2-H		
633	Sed 4dr-6	2450
634	H.T. 4dr-6	2550
632	H.T. 2dr-6	2500
635	Conv 2dr-6	2700
1963-8		
POLARA 500-TD2-P		
642	H.T. 2dr-5	2725
645	Conv 2dr-6	2925
1963-8		
880-TA3-E		
503	Sed 4dr-6	2650
557	Wag 4dr-9	3000
556	Wag 4dr-6	2900
CUSTOM 880-TA3-L		
513	Sed 4dr-6	2750
514	H.T. 4dr-6	2900
512	H.T. 2dr-6	2850
515	Conv 2dr-6	3025
559	Wag H.T. 4dr-9	3150
558	Wag H.T. 4dr-6	3050
"Optional equipment" on 1963 Dodge Series:		
	ADD-Power Brakes	30
	ADD-Power Strg.-Dart	65
	ADD-Power Strg.-Dodge	65
	ADD-Opt. Eng. "225" Dart	40
	ADD-Opt. Eng. "383" V-8	65
	ADD-Torque Flite Trans:	
	Dart	165
	Dodge 6 cyl.	180
	DEDUCT-Std. Trans.-8 cyl.	200
1962-6		
LANCER 170-SL1-L		
713	Sed 4dr-6	1450
711	Sed 2dr-6	1400
756	Wag 4dr-6	1625
LANCER 770-SL1-H		
733	Sed 4dr-6	1500
731	Sed 2dr-6	1450
776	Wag 4dr-6	1675
LANCER 'GT'-SL1-P		
742	H.T. 2dr-6	1650
1962-6-DART		
DART-SD1-L		
413	Sed 4dr-6	1475
411	Sed 2dr-6	1425
456	Wag 4dr-6	1675
DART 330-SD1-M		
423	Sed 4dr-6	1575
421	Sed 2dr-6	1525
422	H.T. 2dr-6	1650
466	Wag 4dr-6	1775
DART 440-SD1-H		
423	Sed 4dr-6	1675
432	H.T. 2dr-6	1750
1962-8-DART		
DART-SD2-L		
513	Sed 4dr-6	1625
511	Sed 2dr-6	1575
556	Wag 4dr-6	1825
DART 330-SD2-M		
523	Sed 4dr-6	1725
521	Sed 2dr-6	1675
522	H.T. 2dr-6	1800
567	Wag 4dr-9	1975
566	Wag 4dr-6	1925
DART 440-SD2-H		
533	Sed 4dr-6	1825
534	H.T. 4dr-6	1950
532	H.T. 2dr-6	1950
535	Cpe Conv 2dr-6	2025
577	Wag 4dr-9	2125
576	Wag 4dr-6	2025
1962-8-DODGE		
POLARA 500-SD2-P		
544	H.T. 4dr-6	2075
542	H.T. 2dr-6	2075
545	Cpe Conv 2dr-6	2175
CUSTOM 880-SD3-L		
613	Sed 4dr-6	2175
614	H.T. 4dr-6	2300
612	H.T. 2dr-6	2300
615	Conv. 2dr-5	2400
659	Sta Wag 4dr-9	2550
658	Sta Wag 4dr-6	2500
"Optional equipment" for 1962:		
	ADD-Power Brakes	
	Lancer	25
	All others	25
	ADD-Power Strg.	
	Lancer	50
	All others	50
	ADD-Optional Engines	
	318" exc. Lancer	20
	225" Lancer	25
	361 exc. Lancer Std. on Polara.	50
	ADD-Transmissions	
	Torque Fl-Lancer-6	95
	Torque Fl-other 6's	145
	DEDUCT-Std. Trans. 8's	145
1961-6		
LANCER 170-RW1-L		
41	Sed 4dr-6	1100
21	Sed 2dr-6	1075
45	Sta Wag 4dr-6	1250
LANCER 770-RW1-H		
41	Sed 4dr-6	1175
23	H.T. 2dr-6	1225
	Cpe. Spt. 2dr-5	1150
45	Sta Wag 4dr-6	1325
1961-6 DART		
SENECA RD3-L		
41	Sed 4dr-6	1050
21	Sed 2dr-6	1025
45	Sta Wag 4dr-6	1225
PIONEER RD3-M		
41	Sed 4dr-6	1100
21	Sed 2dr-6	1075
23	H.T. 2dr-6	1200
45	Sta Wag 4dr-9	1325
45	Sta Wag 4dr-6	1275
PHOENIX RD3-H		
41	Sed 4dr-6	1175
43	H.T. 4dr-6	1300
23	H.T. 2dr-6	1300
1961-8 DART		
SENECA RD4-L		
41	Sed 4dr-6	1200
21	Sed 2dr-6	1175
45	Sta Wag 4dr-6	1375
PIONEER RD4-M		
41	Sed 4dr-6	1250
21	Sed 2dr-6	1225
23	H.T. 2dr-6	1350
45	Sta Wag 4dr-9	1475
45	Sta Wag 4dr-6	1425
PHOENIX RD4-H		
41	Sed 4dr-6	1325
43	H.T. 4dr-6	1450
23	H.T. 2dr-6	1450
27	Conv 2dr-6	1500
1961-8-DODGE		
POLARA RD1-L		
41	Sed 4dr-6	1575
43	H.T. 4dr-6	1700
23	H.T. 2dr-6	1700
27	Conv 2dr-6	1750
46	Sta Wag 4dr-9	1825
46	Sta Wag 4dr-6	1775
"Optional equipment" for 1961 Series:		
	ADD-Power Brakes	20
	ADD-Power Strg.	40
	ADD-225" Eng.	15
	ADD-Auto. Transmission:	
	Lancer	75
	Dart-6	100
	DEDUCT-For Std. Trans. 8 cyl.	100
	ADD-Torque Flite-8 cyls.	20
DART SERIES		
1960-6		
SENECA PD3L		
41	Sed 4dr-6	875
21	Sed Clb 2dr-6	825
45	Sta Wag 4dr-6	1025
PIONEER PD3M		
41	Sed 4dr-6	925
21	Sed Clb 2dr-6	875
23	Sed H.T. 2dr-6	1000
45	Sta Wag 4dr-9	1125
45	Sta Wag 4dr-6	1075
PHOENIX PD3H		
41	Sed 4dr-6	975
43	Sed H.T. 4dr-6	1100
23	Sed H.T. 2dr-6	1100
27	Cpe Conv-6	1150
1960-8		
SENECA PD4-L		
41	Sed 4dr-6	1000
21	Sed Clb 2dr-6	950
45	Sta Wag 4dr-6	1150
PIONEER PD4-M		
41	Sed 4dr-6	1050
21	Sed Clb 2dr-6	1000
23	Sed H.T. 2dr-6	1125
45	Sta Wag 4dr-9	1250
45	Sta Wag 4dr-6	1200
PHOENIX PD4-H		
41	Sed 4dr-6	1100
43	Sed H.T. 4dr-6	1225
23	Sed H.T. 2dr-6	1225
27	Cpe Conv-6	1275
DODGE SERIES		
1960-8		
MATADOR PD1-L		
41	Sed 4dr-6	1175
43	Sed H.T. 4dr-6	1300
23	Sed. H.T. 2dr-6	1300
45	Sta Wag 4dr-9	1375
45	Sta Wag 4dr-6	1325
POLARA PD2-H		
41	Sed 4dr-6	1225
43	Sed H.T. 4dr-6	1350
23	Sed H.T. 2dr-6	1350
27	Cpe Conv-6	1375
46	Sta Wag 4dr-9	1425
46	Sta Wag 4dr-6	1400
Optional equipment for 1960 Dodge-Dart and Dodge:		
	ADD-Power Brakes	15
	ADD-Power Strg.	30
	ADD-383 V-8 Eng. Phoenix 8 only	20
	ADD-Auto. Trans.-6 Cyl.	80
	DEDUCT-Std. Trans.	80
1959-6		
CORONET MD1-L		
41	Sed 4dr-6	700
21	Sed Clb 2dr-6	675
23	Lancer 2dr-6	825
1959-8		
CORONET MD2-L		
41	Sed 4dr-6	825
43	Lancer 4dr-6	925
21	Sed Clb 2dr-6	800
23	Lancer 2dr-6	925
27	Cpe Conv 2dr-6	950
ROYAL MD3-M		
41	Sed 4dr-6	925
43	Lancer 4dr-6	1025
23	Lancer 2dr-6	1025
CUSTOM ROYAL MD3-H		
41	Sed 4dr-6	1000
43	Lancer 4dr-6	1100
23	Lancer 2dr-6	1100
27	Cpe Conv 2dr-6	1125
SIERRA MD3-L		
45A	Sta Wag 2 seat-6	1025
45B	Sta Wag 3-seat-9	1075
CUSTOM SIERRA MD3-H		
45A	Sta Wag 2 seat-6	1075
45B	Sta Wag 3 seat-9	1125
"Optional equipment" for 1959 Dodge:		
	ADD-Power Brakes	15
	ADD-Power Strg.	25
	ADD-Auto. Trans.-6 Cyl.	65
	DEDUCT-Std. Trans.-8 Cyl.	65
	ADD-Torque Flite over Power Flite	15
1958-6		
CORONET		
LD1-L1	Sed 4dr-6	350
LD1-L1	Sed Clb 2dr-6	325
LD1-L1	Lancer 2dr-6	400
1958-8		
CORONET		
LD2-L1	Sed 4dr-6	450
LD2-L1	Lancer 4dr-6	525
LD2-L1	Sed Clb 2dr-6	425
LD2-L1	Lancer 2dr-6	525
LD2-L1	Cpe Conv-6	550
ROYAL		
LD2-M	Sed 4dr-6	525
LD2-M	Lancer 4dr-6	600
LD2-M	Lancer 2dr-6	600
CUSTOM ROYAL		
LD3-H	Sedan 4dr-6	575
LD3-H	Lancer 4dr-6	650
LD3-H	Lancer 2dr-6	650
LD3-H	Reg. Lan. 2dr-6	675
LD3-H	Cpe Conv-6	700
STATION WAGONS		
LD3-L	Sierra 4dr-6	600
LD3-L	Sierra 4dr-9	625
LD3-H	Cus Sierra 4dr-6	650
LD3-H	Cus. Sierra 4dr-9	675
LD3-L	Sub 2dr-6	575
"Optional equipment" for 1958 Dodge:		
	ADD-Power Brakes	15
	ADD-Power Strg.	25
	ADD-Auto. Trans.-6 Cyl.	50
	DEDUCT-Std. Trans. 8 Cyl. only	50

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Model	Body Type	Avg Retail

MERCURY *

Auto. Trans. Included (Exc. 6 Cyl.)

1963-6

MERCURY COMET

54A	Sed 4dr-6	1975
62A	Sed 2dr-6	1925
71A	Wag 4dr-6	2200
59A	Wag 2dr-6	2150

MERCURY COMET CUSTOM

54B	Sed 4dr-6	2050
62B	Sed 2dr-6	2000
63A	Conv 2dr-6	2300
76A	Wag 4dr-6	2275
71B	Wag 2dr-6	2225

SPECIAL S-22

62C	Sed 2dr-6	2150
76B	Conv 2dr-6	2425
71D	Wag 4dr-6	2450

"Optional equipment" on 1963 Mercury Comet Series:

ADD-170" "6" Eng	25
ADD-4 Speed Trans	30
ADD-Merco-O-Matic Trans.	40
ADD-Power Strg	75
ADD-260" V-8 Eng	150

1963-6

METEOR

54A	Sed 4dr-6	2075
62A	Sed 2dr-6	2025
71B	Wag 4dr-6	2325

METEOR CUSTOM

54B	Sed 4dr-6	2150
62B	Sed 2dr-6	2100
65A	H.T. 2dr-6	2175
71C	Wag 4dr-6	2400

METEOR 'S-33'

65B	H.T. 2dr-6	2350

1963-8

METEOR

54A	Sed 4dr-6	2275
62A	Sed 2dr-6	2225
71B	Wag 4dr-6	2525

METEOR CUSTOM

54B	Sed 4dr-6	2350
62B	Sed 2dr-6	2300
65A	H.T. 2dr-6	2375
71C	Wag 4dr-6	2600

METEOR 'S-33'

65B	H.T. 2dr-6	2550

1963-8

MONTEREY

54A	Sed 4dr-6	2625
75A	H.T. 4dr-6	2750
62A	Sed 2dr-6	2575
65A	H.T. 2dr-6	2700

MONTEREY CUSTOM

54B	Sed 4dr-6	2775
75B	H.T. 4dr-6	2900
65B	H.T. 2dr-6	2850
76A	Conv 2dr-6	3050

MONTEREY 'S-55'

75C	H.T. 4dr-5	3175
65C	H.T. 2dr-5	3125
76B	Conv 2dr-5	3325

"Optional equipment" on 1963 Mercury Series:

ADD-Power Brakes	30
ADD-Power Strg.-Meteor	65
ADD-Power Strg-Monterey	90
ADD-260 V-8 Eng	40
ADD-390 V-8 Eng	40
ADD-Overdrive-Meteor	95
ADD-4 Speed Trans.*	215
ADD-Merco-O-Matic 6 cyl.	170
DEDUCT-Std. Trans.-8 cyl.	180
ADD-Multi-Drive*	220

*Monterey Only. Std. on S-55

1962-6

MERCURY COMET

54A	Sed 4dr-6	1625
62A	Sed 2dr-6	1600
71A	Wag 4dr-6	1850
59A	Wag 2dr-6	1800

MERCURY COMET CUSTOM

54B	Sed 4dr-6	1675
62B	Sed 2dr-6	1650
71B	Wag 4dr-6	1900
59B	Wag 2dr-6	1850

SPECIAL MODEL S-22

62C	Sed 2dr-6	1750
71C	Wag 4dr-6	1975

Model	Body Type	Avg Retail

1962-6-MERCURY

METEOR

54A	Sed 4dr-6	1625
62A	Sed 2dr-6	1600

METEOR CUSTOM

54B	Sed 4dr-6	1675
62B	Sed 2dr-6	1650

METEOR S-33

62C	Sed 2dr-6	1750

MONTEREY

54A	Sed 4dr-6	1800
75A	H.T. 4dr-6	1925
62A	Sed 2dr-6	1750
65A	H.T. 2dr-6	1925

STATION WAGONS

71C	Commuter 4dr-9	2025
71A	Commuter 4dr-6	1975

1962-8-MERCURY

METEOR

54B	Sed 4dr-6	1775
62B	Sed 2dr-6	1750

METEOR CUSTOM

54B	Sed 4dr-6	1825
62B	Sed 2dr-6	1800

METEOR S-33

62C	Sed 2dr-6	1900

MONTEREY

54A	Sed 4dr-6	1950
75A	H.T. 4dr-6	2075
62A	Sed 2dr-6	1900
65A	H.T. 2dr-6	2075

STATION WAGONS

71C	Commuter 4dr-9	2175
71A	Commuter 4dr-6	2125

MONTEREY CUSTOM

54B	Sed 4dr-6	2175
75B	H.T. 4dr-6	2300
65B	H.T. 2dr-6	2300
76A	Cpe Conv 2dr-6	2375

MONTEREY CUSTOM S-55

65C	H.T. 2dr-6	2425
76B	Conv. 2dr-5	2475

STATION WAGONS

71D	Colony 4dr-9	2350
71B	Colony 4dr-6	2300

"Optional equipment" for 1962:

ADD-Power Brakes*	25
ADD-Power Strg.*	50
ADD-Optional Engines:	
170 Comet	25
352 V-8	25
390 V-8	80
ADD-Merc-O-Matic-6's	120
DEDUCT-Std. Trans. 8 cyls.	125
ADD-Multi-Drive over Merc-O-Matic	30

*Not available on Mercury Comet

1961-6-COMET

54A	Sed 4dr-6	1300
62A	Sed 2dr-6	1275
71A	Sta Wag 4dr-6	1450
59A	Sta Wag 2dr-6	1400
	ADD-Ford-O-Matic	75

S-22

	Sed 2dr-6	1425
	ADD-Ford-O-Matic	75
	ADD-Fash. Gr.	45
	ADD-170 Eng.	15

1961-8

METEOR '600'

58A	Sed 4dr-6	1425
64A	Sed 2dr-6	1400

METEOR '800'

54A	Sed 4dr-6	1475
75A	H.T. 4dr-6	1600
62A	Sed 2dr-6	1450
65A	H.T. 2dr-6	1600

MONTEREY

54B	Sed 4dr-6	1550
65B	H.T. 4dr-6	1675
65B	H.T. 2dr-6	1675
76A	Conv 2dr-6	1750

STATION WAGONS

	Colony 4dr-9	1725
71B	Colony 4dr-6	1700
	Commuter 4dr-9	1650
71A	Commuter 4dr-6	1625

"Optional equipment" for 1961:

ADD-Power Brakes	20
ADD-Power Strg	40
ADD-Overdrive	45
ADD-352 8 Cyl. Eng	15
ADD-390 8 Cyl. Eng	30
DEDUCT-For 6 cyl.	50
ADD-Merc-O-Matic 6 cyl.	95
DEDUCT-Std. Trans.	95
ADD-Multi-Drive	30

1960-6-COMET

54A	Sed 4dr-6	1025
62A	Sed 2dr-6	1000
71A	Sta Wag 4dr-6	1175
59A	Sta Wag 2dr-6	1150
	ADD-Auto Trans.	75
	Fashion Group	30

1960-8

MONTEREY

58A	Sed 4dr-6	1125
57A	Sed H.T. 4dr-6	1250
64A	Sed 2dr-6	1100
63A	Sed H.T. 2dr-6	1250
76A	Cpe Conv 2dr-6	1300

CTRY CRUISE STA WAG

77A	Commuter 4dr-6	1325

MONTCLAIR

58B	Sed 4dr-6	1200
57B	Sed H.T. 4dr-6	1325
63B	Sed H.T. 2dr-6	1325

CTRY CRUISER STA WAG

77B	Colony 4dr-6	1425

PARK LANE

57F	Sed H.T. 4dr-6	1400
63F	Sed H.T. 2dr-6	1400
76D	Cpe Conv 2dr-6	1475

"Optional equipment" for 1960 Mercury:

ADD-Power Brakes	20
ADD-Power Strg	30
ADD-383" Eng	15
ADD-Multi Drive	15
DEDUCT-Std. Trans. Monterey only	95

1959-8

MONTEREY

58A	Sed 4dr-6	875
57A	Sed H.T. 4dr-6	975
64A	Sed 2dr-6	850
63A	Sed H.T. 2dr-6	975
76A	Cpe Conv 2dr-6	1025

MONTCLAIR

58B	Sed 4dr-6	925
57B	Sed H.T. 4dr-6	1025
63B	Sed H.T. 2dr-6	1025

PARK LANE

57C	Sed H.T. 4dr-6	1075
63C	Sed H.T. 2dr-6	1075
76C	Cpe Conv 2dr-6	1125

CTRY CRUISER STA. WAG.

77A	Commuter 4dr-6	1000
77B	Colony 4dr-6	1075
77D	Voyager 4dr-6	1050
56A	Commuter 2dr-6	975

Optional equipment for 1959 Mercury:

ADD-Pwr Brks Std. Pk Lane	15
ADD-Pwr Strg. Std. Pk Lane	25
ADD-MULTI-DRIVE Over Merc-O-Matic Std. Park Lane	15
DEDUCT-Std. Trans	65

1958-8

MERCURY

58C	Sed 4dr-6	425
64B	Sed 2dr-6	400

MONTEREY

58A	Sed 4dr-6	525
57A	Sed H.T. 4dr-6	600
64A	Sed 2dr-6	500
63A	Sed H.T. 2dr-6	600
76A	Cpe Conv-6	625

MONTCLAIR

58B	Sed 4dr-6	575
57B	Sed H.T. 4dr-6	650
63B	Sed H.T. 2dr-6	650
76B	Cpe Conv-6	675

TURNPIKE CRUISER

75A	Sed H.T. 4dr-6	725
65A	Sed H.T. 2dr-6	725

Model	Body Type	Avg Retail

STATION WAGONS

77A	Commuter 4dr-6	625
77C	Commuter 4dr-9	650
77B	Colony 4dr-6*	725
77D	Voyager 4dr-6*	700
56A	Commuter 2dr-6	600
56B	Voyager 2dr-6	675

PARKLANE

57C	Sed H.T. 4dr-6	850
63C	Sed H.T. 2dr-6	850
76C	Cpe Conv-6	875

Optional equipment for 1958 Mercury:

ADD-Power Brakes	15
ADD-Power Strg	20
ADD-Overdrive	20
DEDUCT-Std. Trans. Merc-O-Matic Std. on Montclair & T-Cruisers	50

OLDSMOBILE

Auto. Trans. Included (Exc. 6 Cyl.)

1963-8-F-85

STANDARD 3000

3019	Sed 4dr-6	2400
3027	Cpe Clb 2dr-6	2350
3035	Wag 4dr-6	2650

DELUXE 3100

3119	Sed 4dr-6	2525
3117	Cutlass Cpe 2dr-5	2475
3167	Cutlass Conv 2dr-5	2825
3135	Wag 4dr-6	2775

JETFIRE 3100

3147	H.T. 2dr-5	2900

1963-8

DYNAMIC

3269	Sed 4dr-6	2950
3239	Holiday H.T. 4dr-6	3100
3247	Holiday H.T. 2dr-6	3025
3267	Conv 2dr-5	3275
3245	Wag 4dr-9	3425
3235	Wag 4dr-6	3350

SUPER 88

3569	Sed 4dr-6	3150
3539	Holiday H.T. 4dr-6	3300
3547	Holiday H.T. 2dr-6	2750
3535	Wag 4dr-6	3550

STARFIRE

3657	Cpe H.T. 2dr-5	3925
3667	Conv 2dr-5	4425

"98"

3819	Sed 4dr-6	3450
3839	Holiday H.T. 4dr-6 4W	3600
3829	H.T. 4dr-6 6W	3675
3847	Holiday H.T. 2dr-6	3550
3947	Cpe Spt 2dr-5	3700
3867	Conv 2dr-5	3775

"Optional equipment" on 1963 Oldsmobile Series:

ADD-Power Brakes*	40
ADD-Power Strg. F-85	65
ADD-Power Strg. 88-S88*	95
ADD-4 Sp. Synchro Trans. F-85 Series Only	190
DEDUCT-Std. Trans.-F-85	180
DECUCT-Std. Trans. 88, S88	200

*Standard on Starfire and 98 Series

1962-8-F-85

3019	Sed 4dr-6	2000
3027	Cpe Clb 2dr-6	1975
3067	Spt. Conv 2dr-6	2200
3045	Wag 4dr-9	2225
3035	Wag 4dr-6	2175

DeLUXE F-85

3119	Sed 4dr-6	2125
3117	Cutlass 2dr-6	2250
3167	Cut. Conv. 2dr-6	2475
3135	Wag 4dr-6	2325

JETFIRE TURBO-CHARGED

	H.T. 2dr-5	2425

1962-8-OLDSMOBILE

DYNAMIC 88

3269	Sed 4dr-6	2400
3239	H.T. 4dr-6	2525
3247	H.T. 2dr-6	2475
3267	Cpe Conv 4dr-6	2700
3245	Wagon 4dr-9	2825
3235	Wag 4dr-6	2775

** Mercury '63 Sportster, Colony Park, and Meteor Country Cruiser not listed (insufficient data)*

CONTINUED

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Model	Body Type	Avg Retail
SUPER 88		
3569	Sed 4dr-6	2575
3539	H.T. 4dr-6	2700
3547	H.T. 2dr-6	2650
3535	Wag 4dr-6	2925
STARFIRE		
3647	H.T. 2dr-6	3050
3667	Cpe Conv 2dr-6	3325
'98'		
3819	Twn 4dr-6	2850
3839	H.T. Spt. 4dr-6	2975
3829	H.T. 4dr-6	2925
3847	H.T. Spt. 2dr-6	2900
3867	Cpe Conv 2dr-6	3175
"Optional equipment" for 1962:		
ADD-Power Brakes*		30
ADD-Power Strg. F-85		50
ADD-Power Strg. 88-S88*		65
ADD-185 Eng. F-85		25
ADD-Skyrocket Eng. 88		20
DEDUCT-Std. Trans. F-85		125
DEDUCT-Std. Trans.*		150
*Std. on 98.		
1961-8-F-85		
STANDARD F-85		
3019	Sed 4dr-6	1600
3027	Cpe Club 2dr-6	1575
3045	Wag 4dr-9 3 seat	1825
3035	Wag 4dr-6 2 seat	1800
DeLUXE F-85		
3119	Sed 4dr-6	1675
3117	Cutlass 2dr-6	1875
3145	Wag 4dr-9 3 seat	1900
3135	Wag 4dr-6 2 seat	1875
1961-8		
DYNAMIC '88'		
3269	Sed 4dr-6	1850
3239	Holiday 4dr-6	1975
3211	Sed 2dr-6	1800
3237	Holiday 2dr-6	1975
3267	Conv 2dr-6	2075
3245	Wag 4dr-6 3 seat	2150
3235	Wag 4dr-6 2 seat	2100
SUPER '88'		
3569	Sed 4dr-6	2025
3539	Holiday 4dr-6	2150
3537	Holiday 2dr-6	2150
3567	Conv 2dr-6	2200
3545	Wag 4dr-6 3 seat	2250
3535	Wag 4dr-6 2 seat	2200
STARFIRE		
3667	Conv 2dr-6	2725
SERIES '98'		
3819	Sed Twn 4dr-6	2150
3839	Sed Spt 4dr-6	2275
3829	Holiday 4dr-6	2275
3837	Holiday 2dr-6	2275
3867	Conv 2dr-6	2375
"Optional equipment" for 1961:		
ADD-Power Brakes**		25
ADD-Power Strg. F-85		40
ADD-Power Strg.*		50
DEDUCT-Std. Trans.		
F-85		95
88 & S88		125
**N.A. on F-85		
1960-8		
DYNAMIC 88		
3219	Sed 4dr-6	1500
3239	Holiday 4dr-6	1625
3211	Sed 2dr-6	1475
3237	Holiday 2dr-6	1625
3267	Cpe Conv-6	1675
3245	Fiesta S.W.-6	1775
3235	Fiesta S.W.-6	1725
SUPER 88		
3519	Sed 4dr-6	1600
3539	Holiday 4dr-6	1725
3537	Holiday 2dr-6	1725
3567	Cpe Conv-6	1775
3545	Fiesta S.W.-6	1875
3535	Fiesta S.W.-6	1825
SERIES 98		
3819	Sed 4dr-6	1725
3839	Holiday 4dr-6	1850
3837	Holiday 2dr-6	1850
3867	Cpe Conv-6	1900

Model	Body Type	Avg Retail
"Optional equip." for 1960 Oldsmobile:		
ADD-Power Brakes		20
Std. on 98		
ADD-Power Strg.		45
Std. on 98		
DEDUCT-Std. Trans.		95
Std. on 98		
1959-8		
DYNAMIC 88		
3219	Sed 4dr-6	1150
3239	Holiday 4dr-6	1250
3211	Sed 2dr-6	1125
3237	Holiday 2dr-6	1250
3267	Cpe Conv-6	1300
3535	Fiesta S.W.-6	1325
SUPER 88		
3519	Sed 4dr-6	1225
3539	Holiday 4dr-6	1325
3537	Holiday 2dr-6	1325
3567	Cpe Conv-6	1375
3535	Fiesta S.W.-6	1400
SERIES 98		
3819	Sed 4dr-6	1300
3839	Holiday 4dr-6	1400
3837	Holiday 2dr-6	1400
3867	Cpe Conv-6	1450
"Optional equip." for 1959 Oldsmobile:		
ADD-Power Brakes		20
Std. on 98		
ADD-Power Strg.		40
Std. on 98		
DEDUCT-Std. Trans.		65
Std. on 98		
1958-8		
DYNAMIC 88		
3669	Sed 4dr-6	725
3639	Holiday 4dr-6	800
3611	Sed 2dr-6	700
3637	Holiday 2dr-6	800
3667TX	Cpe Conv-6	825
3693	Fiesta-6	825
3695	Fiesta H.T.-6	850
SUPER S88		
3669D	Sed 4dr-6	800
3639SD	Holiday 4dr-6	875
3637SD	Holiday 2dr-6	875
3667DTX	Cpe Conv-6	900
3695SD	Fiesta H.T.-6	925
SERIES "98"		
3069D	Sed 4dr-6	850
3039SDX	Holiday 4dr-6	925
3037SDX	Holiday 2dr-6	925
3067DX	Cpe Conv-6	950
"Optional equip." for 1958 Oldsmobile:		
ADD-Power Brakes		15
Std. on 98		
ADD-Power Strg.		30
Std. on 98		
DEDUCT-Std. Trans.		50
Std. on 98		

RAMBLER *

Auto. Trans. Included (Exc. 6 Cyl.)

Model	Body Type	Avg Retail
1963-6		
AMERICAN 220		
6305	Sed 4dr-6	1750
6306	Sed 2dr-6	1700
6302	Sed Bus 2dr-3	1675
6308	Wag 4dr-6	1950
6304	Wag 2dr-6	1900
AMERICAN 330		
6305-2	Sed 4dr-6	1800
6306-2	Sed 2dr-6	1750
6308-2	Wag 4dr-6	2000
6304-2	Wag 2dr-6	1950
AMERICAN 440		
6305-5	Sed 4dr-6	1900
6306-5	Sed 2dr-6	1850
6309-5	H.T. 2dr-6	1950
6309-7	H.T. 2dr-4 (440H)	2050
6307-5	Conv 2dr-5	2125
6308-5	Wag 4dr-6	2100
1963-6		
CLASSIC 550		
6315	Sed 4dr-6	2000
6316	Sed 2dr-6	1975
6318	Wag 4dr-6	2300

Model	Body Type	Avg Retail
1963-6		
CLASSIC 660		
6315-2	Sed 4dr-6	2125
6316-2	Sed 2dr-6	2100
6318-4	Wag 5dr-8	2425
6318-2	Wag 4dr-6	2375
CLASSIC 770		
6315-5	Sed 4dr-6	2225
6316-5	Sed 2dr-6	2175
6318-5	Wag 4dr-6	2450
1963-8		
AMBASSADOR 880		
6385-2	Sed 4dr-6	2400
6386-2	Sed 2dr-6	2350
6388-2	Wag 4dr-6	2625
AMBASSADOR 990		
6385-5	Sed 4dr-6	2500
6386-5	Sed 2dr-6	2450
6388-6	Wag 5dr-8	2775
6388-5	Wag 4dr-6	2725
"Optional equipment" on 1963 Rambler Series		
ADD-Power Brakes:		
American		25
Classic		30
Ambassador		30
ADD-Power Strg.		
American		50
Classic		50
Ambassador		65
V-8 Engine-Classic Series		
ADD-Overdrive:		
American		90
Classic		95
Ambassador		95
ADD-Automatic Trans:		
American		150
Classic 6 cyl		175
DEDUCT-Std. Trans.-8 cyl		215
1962-6		
AMERICAN DeLUXE		
6205	Sed 4dr-6	1300
6206	Sed 2dr-6	1275
6208	Wag 4dr-6	1475
6204	Wag 2dr-6	1425
AMERICAN CUSTOM		
6205-2	Sed 4dr-6	1350
6206-2	Sed 2dr-6	1325
6208-2	Wag 4dr-6	1525
6204-2	Wag 2dr-6	1475
AMERICAN CUSTOM		
6205-5	Sed 4dr-6	1425
6206-5	Sed 2dr-6	1400
6207-5	Cpe Conv 2dr-5	1575
6208-5	Wag 4dr-6	1550
1962-6-SERIES 6210		
CLASSIC DeLUXE		
6215	Sed 4dr-6	1525
6216	Sed 2dr-6	1500
6218	Wag 4dr-6	1625
CLASSIC CUSTOM		
6215-2	Sed 4dr-6	1625
6216-2	Sed 2dr-6	1600
6218-2	Wag 4dr-6	1725
6218-4	Wag 5dr-6	1775
CLASSIC 400		
6215-5	Sed 4dr-6	1725
6216-5	Sed 2dr-6	1700
6218-5	Wag 4dr-6	1825
1962-8-SERIES 6280		
AMBASSADOR CUSTOM		
6285-2	Sed 4dr-6	1850
6286-2	Sed 2dr-6	1825
6288-2	Wag 4dr-6	2050
AMBASSADOR 400		
6285-5	Sed 4dr-6	1950
6286-5	Sed 2dr-6	1925
6288-5	Wag 4dr-6	2150
6288-6	Wag 5dr-6	2200
"Optional equipment" for 1962:		
ADD-Power Brakes-6 cyl.		25
ADD-Power Brakes-8 cyl.		30
ADD-Power Strg-6 cyl.		50
ADD-Power Strg-8 cyl.		50
ADD-Overdrive 6 cyl.		65
ADD-Overdrive 8 cyl.		65
ADD-Automatic Trans:		
American-6 cyl.		95
Classic-6 cyl.		120
DEDUCT-Std. Trans. 8's		125

Model	Body Type	Avg Retail
1961-6		
AMERICAN DeLUXE		
6105	Sed 4dr-6	975
6106	Sed 2dr-6	950
6108	Sta Wag 4dr-6	1075
6104	Sta Wag 2dr-6	1050
AMERICAN SUPER		
6105-1	Sed 4dr-6	1025
6106-1	Sed 2dr-6	1000
6108-1	Sta Wag 4dr-6	1125
6104-1	Sta Wag 2dr-6	1100
AMERICAN CUSTOM		
6105-2	Sed 4dr-6	1075
6106-2	Sed 2dr-6	1050
6107-2	Conv 2dr-5	1150
6108-2	Sta Wag 4dr-6	1175
6104-2	Sta Wag 2dr-6	1150
AMERICAN CUSTOM 400		
6105-5	Sed 4dr-6	1125
6107-5	Cpe Conv 2dr-5	1225
1961-6-SERIES 6110		
RAMBLER CLASSIC DeLUXE		
6115	Sed 4dr-6	1150
6118	Sta Wag 4dr-6	1275
RAMBLER CLASSIC SUPER		
6115-1	Sed 4dr-6	1200
6118-3	Sta Wag 5dr-8	1400
6118-1	Sta Wag 4dr-6	1325
RAMBLER CLASSIC CUSTOM		
6115-2	Sed 4dr-6	1275
6118-4	Sta Wag 5dr-8	1475
6118-2	Sta Wag 4dr-6	1400
CLASSIC CUSTOM 400		
6115-5	Sed 4dr-6	1350
1961-8-SERIES 6120		
RAMBLER CLASSIC DeLUXE		
6125	Sed 4dr-6	1225
RAMBLER CLASSIC SUPER		
6125-1	Sed 4dr-6	1275
6128-3	Sta Wag 5dr-8	1475
6128-1	Sta Wag 4dr-6	1425
RAMBLER CLASSIC CUSTOM		
6125-2	Sed 4dr-6	1350
6128-4	Sta Wag 5dr-8	1550
6128-2	Sta Wag 4dr-6	1500
CLASSIC CUSTOM 400		
6125-5	Sed 4dr-6	1400
1961-8-SERIES 6180		
AMBASSADOR DeLUXE		
6185	Sed 4dr-6	1300
AMBASSADOR SUPER		
6185-1	Sed 4dr-6	1375
6188-3	Sta Wag 5dr-8	1575
6188-1	Sta Wag 4dr-6	1525
AMBASSADOR CUSTOM		
6185-2	Sed 4dr-6	1450
6188-4	Sta Wag 5dr-8	1650
6188-2	Sta Wag 4dr-6	1600
AMBASSADOR CUSTOM 400		
6185-5	Sed 4dr-6	1525
"Optional equipment" for 1961 Series:		
ADD-Power Brakes:		
Amer. & Classic		20
Amb.		25
ADD-Power Strg.:		
Amer. & Classic		45
Amb.		50
ADD-Overdrive:		
American		50
Classic & Amb.		50
ADD-Flash-O-Matic:		
American		75
Classic 6 cyl.		95
DEDUCT-Std. Trans. 8's		95
1960-6		
AMERICAN DeLUXE		
6005	Sed 4dr-5	650
6006	Sed 2dr-5	625
6004	Sta Wag 2dr-5	725
AMERICAN SUPER		
6005-1	Sed 4dr-5	725
6006-1	Sed 2dr-5	700
6004-1	Sta Wag 2dr-5	825
AMERICAN CUSTOM		
6005-2	Sed 4dr-5	775

* *Rambler '63 Ambassador not listed (insufficient data)*

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Model	Body Type	Avg Retail
6006-2	Sed 2dr-5	750
6004-2	Sta Wag 2dr-5	875
RAMBLER DeLUXE		
6015	Sed 4dr-6	850
6018	Sta Wag 4dr-6	925
RAMBLER SUPER		
6015-1	Sed 4dr-6	925
6018-1	Sta Wag 4dr-6	1000
6018-3	Sta Wag 4dr-8	1050
RAMBLER CUSTOM		
6015-2	Sed 4dr-6	975
6019-2	Sed H.T. 4dr-6	1000
6018-2	Sta Wag 4dr-6	1050
6018-4	Sta Wag 4dr-8	1100
1960-8-6020		
REBEL SUPER		
6025-1	Sed 4dr-6	1025
6028-1	Sta Wag 4dr-6	1100
6028-3	Sta Wag 4dr-8	1150
REBEL CUSTOM		
6025-2	Sed 4dr-6	1100
6029-2	Sed H.T. 4dr-6	1150
6028-2	Sta Wag 4dr-6	1175
6028-4	Sta Wag 4dr-8	1225
1960-8-6080		
AMBASSADOR-SUPER		
6085-1	Sed 4dr-6	1100
6088-1	Sta Wag 4dr-6	1150
6088-3	Sta Wag 4dr-8	1200
AMBASSADOR CUSTOM		
6085-2	Sed 4dr-6	1175
6089-2	Sed H.T. 4dr-6	1200
6088-2	Sta Wag 4dr-6	1225
6083-2	Sta Wag H.T. 4dr-6	1275
6088-4	Sta Wag 4dr-8	1275
"Optional equipment" for 1960 Rambler:		
ADD-Power Brakes		20
ADD-Power Str		30
ADD-Overdrive		45
ADD-Flash-O-Matic: 6 Cyl.		65
DEDUCT-Std. Trans. 8 Cyl. only		75
1959-6		
AMERICAN DELUXE		
5906	Sed 2dr-6	450
5904	Sta Wag 2dr-5	550
AMERICAN SUPER		
5906-1	Sed 2dr-6	500
5904-1	Sta Wag 2dr-5	600
RAMBLER DELUXE		
5915	Sed 4dr-6	625
5918	Ctry Wag 4dr-6	700
RAMBLER SUPER		
5915-1	Sed 4dr-6	675
5919-1	Sed H.T. 4dr-6	700
5918-1	Ctry Wag 4dr-6	750
RAMBLER CUSTOM		
5915-2	Sed 4dr-6	750
5918-2	Ctry Wag 4dr-6	825
1959-8		
RAMBLER REBEL SUPER		
5925-1	Sed 4dr-6	750
5928-1	Ctry Wag 4dr-6	825
RAMBLER REBEL CUSTOM		
5925-2	Sed 4dr-6	825
5929-2	Sed H.T. 4dr-6	875
5928-2	Ctry Wag 4dr-6	900
RAMBLER AMBASSADOR SUPER		
5985-1	Sed 4dr-6	850
5988-1	Ctry Wag 4dr-6	975
RAMBLER AMBASSADOR CUSTOM		
5985-2	Sed 4dr-6	925
5989-2	Sed H.T. 4dr-6	1000
5988-2	Ctry Wag 4dr-6	1050
5983-2	Sta Wag H.T. 4dr-6	1100
"Optional equipment" for 1959 Rambler:		
ADD-Power Brakes		15
ADD-Power Strg		25
ADD-Overdrive		30
ADD-Flash-O-Matic. 6 Cyl.		65
DEDUCT-Std. Trans. 8 Cyl. only		65

Model	Body Type	Avg Retail
1958-6-AMERICAN 5800		
DELUXE		
5806	Sed 2dr-5	325
SUPER		
5806-1	Sed 2dr-5	350
1958-6-RAMBLER 5810		
DELUXE		
5815	Sed 4dr-6	475
5818	Sta Wag 4dr-6	525
SUPER		
5815-1	Sed 4dr-6	550
5819-1	Sed H.T. 4dr-6	575
5818-1	Cr Ctry 4dr-6	600
CUSTOM		
5815-2	Sed 4dr-6	600
5818-2	Cr Ctry 4dr-6	650
1958-8-REBEL 5820		
DELUXE		
5825	Sed 4dr-6	575
SUPER		
5825-1	Sed 4dr-6	600
5828-1	Cr Ctry 4dr-6	650
CUSTOM		
5825-2	Sed 4dr-6	650
5829-2	Sed H.T. 4dr-6	675
5828-2	Cross Ctry 4dr-6	700
1958-8-AMBASSADOR 5880		
SUPER		
5885-1	Sed 4dr-6	675
5888-1	Cross Ctry 4dr-6	725
CUSTOM		
5885-2	Sed 4dr-6	725
5889-2	Sed H.T. 4dr-6	750
5888-2	Cross Ctry 4dr-6	775
5883-2	Sta Wag H.T. 4dr-6	800
"Optional equipment" for 1958 Rambler:		
ADD-Power Brakes*		15
ADD-Power Strg.*		20
ADD-Overdrive		20
ADD-Auto Trans. 6 Cyl only		50
DEDUCT-Std. Trans. 8 Cyl. only		50
*N.A. on American 6 Cyl.		

STUDEBAKER *

Auto. Trans. Included (Exc. 6 Cyl.)

Model	Body Type	Avg Retail
1963-6-635		
LARK V1 REGAL		
Y4	Sed 4dr-6	1900
F4	Sed 2dr-6	1850
P4	Wag 4dr-6	2175
LARK V1 CUSTOM		
Y6	Sed 4dr-6	2000
F6	Sed 2dr-6	1950
LARK V1 DAYTONA		
J8	H.T. 2dr-6	2100
L8	Conv 2dr-6	2375
P8	Wag 4dr-6	2400
1963-8-63V		
LARK VIII-REGAL		
Y4	Sed 4dr-6	2125
F4	Sed 2dr-6	2075
P4	Wag 4dr-6	2400
LARK VIII CUSTOM		
Y6	Sed 4dr-6	2225
F6	Sed 2dr-6	2175
LARK VIII DAYTONA		
J8	H.T. 2dr-6	2325
L8	Conv 2dr-6	2600
P8	Wag 4dr-6	2625
"Optional equipment" on 1963 Studebaker Series		
ADD-Power Brakes		30
ADD-Power Strg.		65
ADD-Power Strg. Avanti		50
ADD-Overdrive		95
ADD-4 Speed Fl. Shift		170
ADD-Flight-O-Matic Trans. 6 cyl		170
DEDUCT-Std. Trans.-8 cyl. Except Avanti		175
DEDUCT-Std. Trans.-8 cyl. Avanti only		190

Model	Body Type	Avg Retail
1962-6		
LARK V1-DeLUXE		
Y4	Sed 4dr-6	1425
F4	Sed 2dr-6	1400
P4	Wag 4dr-6	1600
LARK V1-REGAL		
Y6	Sed 4dr-6	1525
J6	H.T. 2dr-6	1600
L6	Cpe Conv 2dr-6	1800
P6	Wag 4dr-6	1700
LARK V1-DAYTONA		
J8	H.T. 2dr-6	1700
L8	Cpe Conv 2dr-6	1850
1962-8		
LARK VIII-DeLUXE		
Y4	Sed 4dr-6	1575
F4	Sed 2dr-6	1550
P4	Wag 4dr-6	1825
LARK VIII-REGAL		
Y6	Sed 4dr-6	1675
J6	H.T. 2dr-6	1750
L6	Cpe Conv 2dr-6	1900
P6	Wag 4dr-6	1900
LARK VIII-DAYTONA		
J8	H.T. 2dr-6	1875
L8	Cpe Conv 2dr-6	1950
LARK VIII-CRUISER		
Y8	Sed 4dr-6	1800
1962-8-HAWK		
GRAN TURISMO		
K6	H.T. 2dr-5	2125
"Optional equipment" for 1962:		
ADD-Power Brakes		25
ADD-Power Strg.		50
ADD-Overdrive		65
ADD-4 Speed Trans.		120
ADD-Auto. Trans.-6 cyl.		95
DEDUCT-Std. Trans. 8's		125
1961-6		
LARK DELUXE		
W4	Sed 4dr-6	1050
F4	Sed 2dr-6	1025
REGAL		
W6	Sed 4dr-6	1125
J6	Sed H.T. 2dr-6	1200
L6	Conv 2dr-6	1250
STATION WAGONS		
P4	DeLuxe 4dr-6	1250
D4	DeLuxe 2dr-6	1200
P6	Regal 4dr-6	1275
1961-8-LARK DELUXE		
W4	Sed 4dr-6	1225
F4	Sed 2dr-6	1200
REGAL		
W6	Sed 4dr-6	1300
J6	Sed H.T. 2dr-6	1350
L6	Conv 2dr-6	1400
LARK CRUISER		
Y6	Sed 4dr-6	1375
STATION WAGONS		
P4	DeLuxe 4dr-6	1400
D4	DeLuxe 2dr-6	1350
P6	Regal 4dr-6	1450
1961-8-HAWK		
C6	Cpe Spt 2dr-6	1500
"Optional equipment" for 1961:		
ADD-Power Brakes		20
ADD-Power Strg.		40
ADD-Overdrive		45
ADD-Flight-O-Matic 6 cyl.		75
DEDUCT-Std. Trans. 8 Cyl. only		95
ADD-4 Sp. Fl. Shift		95
1960-6		
LARK DELUXE		
W4	Sed 4dr-6	725
F4	Sed 2dr-6	700
P4	Sta Wag 4dr-6	825
D4	Sta Wag 2dr-6	800
LARK REGAL		
W6	Sed 4dr-6	800

Model	Body Type	Avg Retail
J6	Hardtop 2dr-6	850
L6	Cpe Conv-6	900
P6	Sta Wag 4dr-6	900
1960-8		
LARK DELUXE		
W4	Sed 4dr-6	850
F4	Sed 2dr-6	825
P4	Sta Wag 4dr-6	950
D4	Sta Wag 2dr-6	925
LARK REGAL		
W6	Sed 4dr-6	925
J6	Hardtop 2dr-6	975
L6	Cpe Conv-6	1025
P6	Sta Wag 4dr-6	1025
HAWK		
C6	Cpe Spt-6	1050
"Optional equip." for 1960 Studebaker:		
ADD-Power Brakes		20
ADD-Power Strg.		30
ADD-Overdrive		30
ADD-Flight-O-Matic 6 Cyl. only		75
DEDUCT-Std. Trans. 8 Cyl. only		75
1959-6		
LARK DELUXE		
W4	Sed 4dr-6	525
F4	Sed 2dr-6	500
D4	Sta Wag 2dr-6	600
LARK REGAL		
W6	Sed 4dr-6	550
J6	Hardtop 2dr-6	575
D6	Sta Wag 2dr-6	625
SILVER HAWK		
C6	Cpe Spt 2dr-6	725
1959-8		
LARK REGAL		
W6	Sed 4dr-6	675
J6	Hardtop 2dr-6	775
D6	Sta Wag 2dr-6	825
SILVER HAWK		
C6	Cpe Spt 2dr-6	650
Optional equipment for 1959 Studebaker:		
ADD-Power Brakes		15
ADD-Power Strg.		25
ADD-Overdrive		25
ADD-Auto Trans.-6 cyl. only		65
DEDUCT-Std. Trans. 8 cyl. only		65
1958-6-SCOTSMAN		
58G-W1	Sed 4dr-6	300
58G-F1	Sed 2dr-6	275
58G-D1	Sta Wag 2dr-6	325
CHAMPION		
58G-W4	Sed 4dr-6	375
58G-F4	Sed 2dr-6	350
SILVER HAWK		
58G-C3	Coupe-5	500
1958-8-COMMANDER		
58B-W4	Sed 4dr-6	425
58B-J4	Sed H.T. 2dr-6	450
58B-P4	Provincial 4dr-6	475
1958-8-PRESIDENT		
58H-Y6	Sed 4dr-6	500
58H-J6	Sed H.T. 2dr-6	525
SILVER HAWK		
58H-C3	Coupe-6	550
1958-8-GOLDEN HAWK		
58H-K7	Cpe H.T.-6	650
Optional equipment for 1958 Studebaker:		
ADD-Power Brakes*		15
ADD-Power Strg.*		20
ADD-Overdrive**		20
ADD-Flightomatic* 6 cyl. only		50
DEDUCT-Std. Trans. 8 cyl. only		50
*Not available on Scotsman		
**Std. on Golden Hawk		

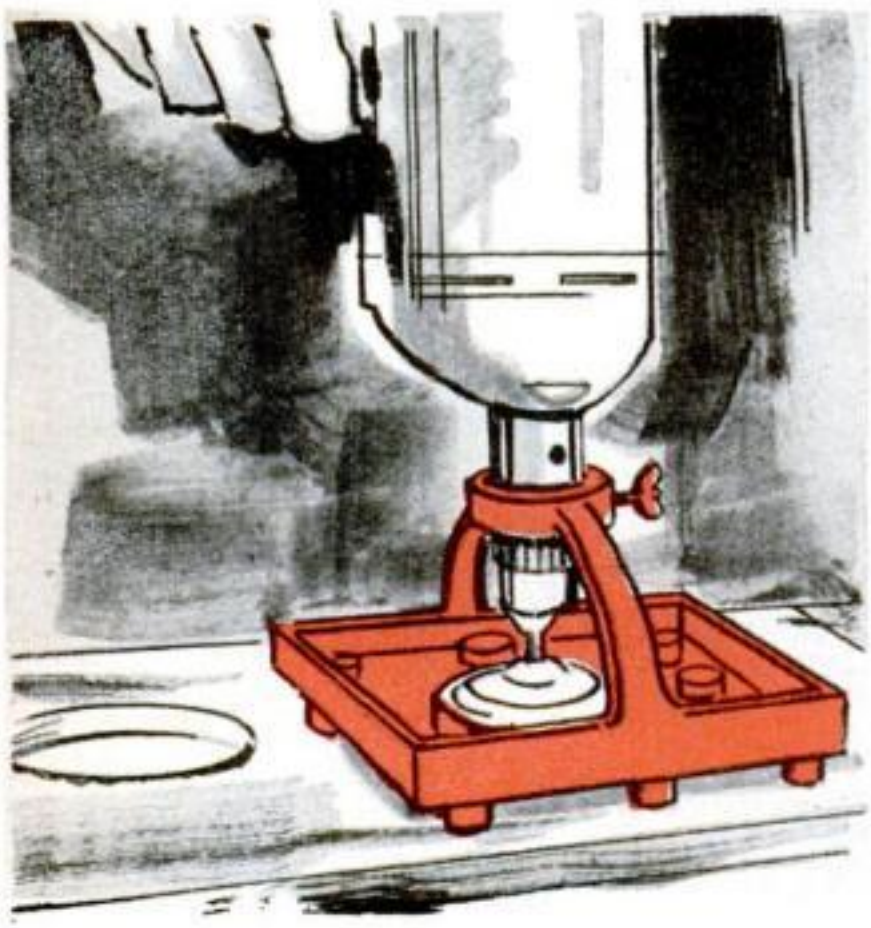
** Studebaker '63 Avanti, Hawk, Lark Cruiser, Lark Standard not listed (insufficient data)*

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New ideas from the inventors

Counter speeds service. This recent invention might cut waiting in a plant cafeteria, say, by letting each diner set his own place at counter or table. He'd do it by flipping over a tray to turn up a fresh setting, turning the soiled side down to be scrubbed by a rotating brush inside. Clips would hold cutlery and cups; a conveyor would carry out waste.



Drill jig aligns cutter. By centering and steadying an ordinary hole cutter in an electric drill, this attachment would make it easier to cut a perfect circle, holding the cutter vertical and eliminating the need for disfiguring pilot holes. Compressible rubber feet would grip the surface to prevent scars caused by cutter "walk."



Plastic cuts lens glare. You could convert your prescription eyeglasses to sunglasses by pressing on these shields made of the plastic film that clings to surfaces electrostatically, but peels off. Unlike clip-on sun lenses, the tinted film would not weight your frames or affect the optical properties of the eyeglass lenses.

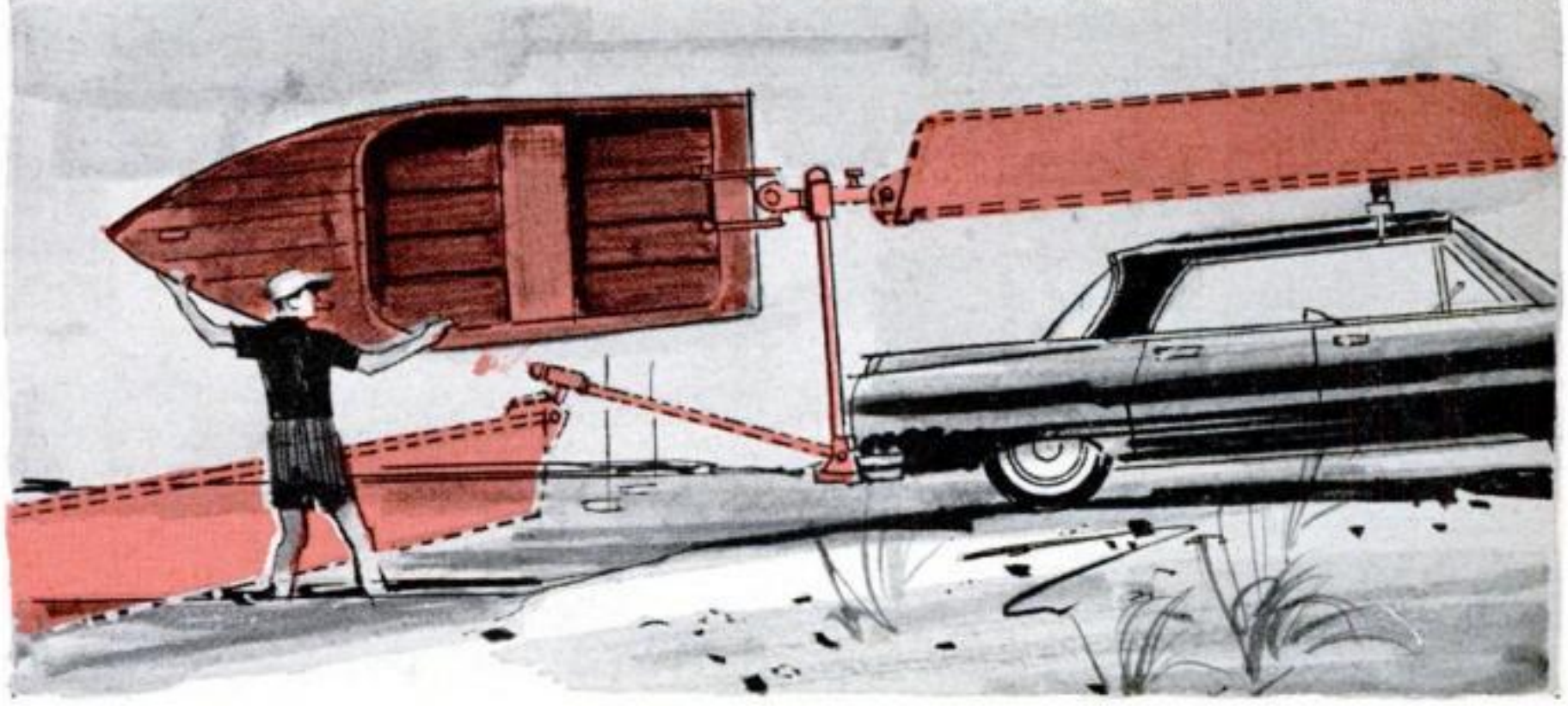
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Flexing sheet propels diver. A scuba diver might travel under water faster and easier —and with less turbulence—on this snake-like craft. By lying on a frame and manipulating a crank, he'd undulate a rubbery sheet beneath him. The inventor claims the flexing would simulate the movements with which a fish or reptile propels itself.



Bottle bib catches drips. Looped around the neck of a bottle, this absorbent strip would stop drips on the way down and soak them up before they could stain a tablecloth or mar a table top. The slightly curved strip, cut from any absorbent fabric or paper, would be slotted near one end so the other end could be pulled through.



Car hitch loads boat. Universal couplings on the ends of this boat-loading post would let one man lift his boat in toward the support and walk it around to the car-top cradle. Tipping the boat would drain it as he walked. To offload, he'd reverse the steps; and use the pole's reach to set the boat down in—or near—the water.

The following patents have been issued on these inventions: **Lunch counter**—*No. 3,075,215 to E. Marue, Northridge, Calif.;* **Cutter jig**—*No. 3,065,654 to L. J. Critelli, and C. Riccio, Long Branch, N.J.;* **Lens shields**—*No. 3,033,359 to S. N. Mercer, Tiburon, Calif.;* **Diver's craft**—*No. 3,048,141 to J. E. Fisk, Mayfield Heights, Ohio;* **Bottle bib**—*No. 3,063,590 to P. S. Hopkins, Muttontown, N.Y.;* **Boat loader**—*No. 3,072,274 to H. N. Atwell, Milwaukee, Wis.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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Ocean Currents—



By Ira Wolfert

From ocean to ocean flow the world's currents—some far down like great undersea rivers, others on the surface. All are part of a huge circulatory system, bringing the essentials of life to the sea's creatures

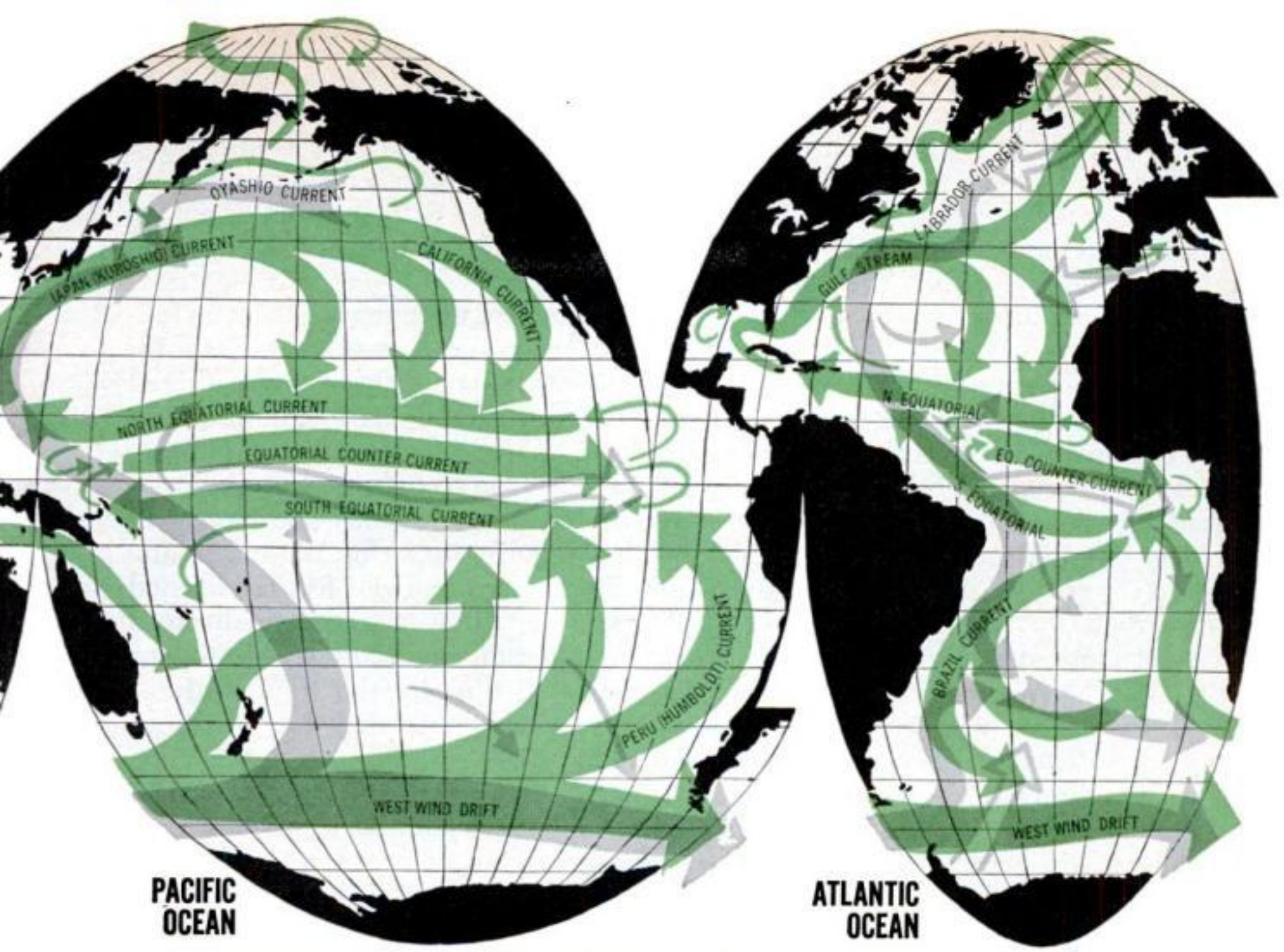
EVER since the first sailor dared challenge the sea, man has been vaguely aware of ocean currents. But only recently have scientists begun unlocking this mystery of the sea, and we now know that throughout the Seven Seas ocean currents, like rivers, are moving in an orderly, understandable fashion—carrying water from one ocean to another, at depths of as much as six miles—all continuous, all tied in together.

Every schoolboy has heard of the magnificent Gulf Stream, the massive 50-mile-wide current, equal to several thousand Mississippi Rivers, that moves millions of tons of water from the Florida Straits all the way to the Arctic Ocean. Rolling along at 100 miles a day, this river of warm water flows to a depth of 6,000 feet, between banks of cold water. At the far end of its journey —in withering Greenland waters—I once stood and watched its warmth make the icebergs sweat.

But new findings reveal that the Gulf Stream is only one of an intricate, interlocking system of currents that lace the oceans. The Brazil Current in the South Atlantic is nearly as great. So are the Kuroshio in the North Pacific, the Agulhas in the Indian Ocean. There are colossal cold rivers, too, coursing along up the west coast of South America and the west coast of Africa, down the west coast of the United States and Mexico. These currents bring the same water that rolled off the coast of Japan to the coast of India or California, and on to Africa or England.

An oceanographer I know, who has a summer cottage on the New Jersey shore, took advantage of this fact to tease his wife over her yen for travel to far places. He made computations from

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Major ocean areas all have similar systems of surface currents, shown in color: clockwise in the northern hemisphere, counterclockwise in the southern. Subsurface currents (open arrows) and bottom currents (gray) flow independently. Many bottom currents are still uncharted.

a current chart, then invited her to the beach for a dip in the Mediterranean of last year. But she had studied oceanography, too. "Let's wait till tomorrow," she said. "I'd rather swim in the Indian Ocean."

AS A glance at the map shows, outside the continental land masses there is only one world ocean. All the rivers, seas, gulfs, bays, channels, and straits are connected to larger bodies that, in turn, are connected to each other in both the Antarctic and Arctic. The currents in them form a single network and regularly shunt trains of water from track to track at the rate of millions of tons a second without regard for geographical boundaries.

There are a number of important reasons why so many countries are spending millions of dollars to send scientists into the deep. For instance, the temperatures of various currents have been found to toy trickily with sound waves. In our age, when atomic submarines armed with nuclear missiles wish to move unseen and unheard throughout the world's oceans, it is a matter of life and death to recognize which waters will permit no sound to come out, and which, perhaps only a few feet deeper, will permit a sound no louder than a backfire of a truck to pass through 6,000 miles of water nearly unmuffled.

There's another reason for the deadly earnestness of ocean research: We used to think we could dump radioactive debris into the deeper sections of the ocean, there to leave it, harmless. But new findings have shown that even in the deepest areas of the ocean, the currents are moving, transporting water and waste throughout the world.

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Last summer, for instance, the French bathyscaphe Archimedes found an ocean current moving five miles down off the coast of Japan. In 1960, the U.S. bathyscaphe Trieste, going 6½ miles down to the bottom of the greatest known deep, the Marianas Trench off the Philippines, found an ocean current even there, working its way along.

THESE discoveries reinforce the picture of the currents as an equivalent of, say, our own bloodstream. Just as our blood flows throughout our bodies, carrying life-giving elements, so the ocean body gets essential nutriments from the land—and oxygen from the air—by means of the currents.

An even more startling discovery has been made. The rivers that flow just under the waves have other rivers flowing under them—sometimes, but not always, in the same direction. Under the Gulf Stream as it speeds north is an island of motionlessness with, under that, an as yet unnamed and unmapped river making its way south. Under the Equatorial Current in the Pacific as it flows west is a 7,000-mile-long river (the Cromwell Current) that flows east, while under it is yet another river flowing west.

The best place in the world for standing on shore and watching the awesome drama of an ocean current at work is one of the cliffs that line the coast of Peru. There the wind blows steadily from the land, driving away the surface water. From the stone-black, airless depths 600 to 1,000 feet below surface, rises a river of cold water known as the Peru or Humboldt Current. This river rides the surface for some 1,500 miles, from Valparaiso, Chile, approximately, to Cabo Blanco in Northern Peru.

It rides along past parched desert country. Above it move millions of birds —armies of pelicans in long files, great black clouds of cormorants, gannets plunging as numerously as raindrops. They have all come to the current to feed on the fish that are fed by it.

The birds whiten the cliffs with 5,000 tons of valuable guano fertilizer every year. It has been calculated from the droppings that they take more fish from this one current, annually, than U. S. commercial fishermen take from all the oceans and seas. The birds leave enough to make Peru's relatively unmechanized fishing industry second only to Japan's in the world.

So important are currents that the failure of one to meet its timetable can hit like an earthquake. Florida's dread "red tides" are an example. Over the winter of 1946-47, they produced an epidemic of the sneezing, coughing, burning-eyed symptoms of heavy colds and hay fever while, offshore, in a clot 120 miles long and 20 miles wide, dead fish lay massed like seaweed. It was traced finally to a rare population explosion of a poisonous organism. Ordinarily the tiny creatures are dispersed before they are numerous enough to do any harm, but this time the Gulf Stream had dawdled somewhere on its appointed round.

In 1957, a Soviet vessel in the Arabian Sea, en route from Ceylon to the Gulf of Aden, reported passing through 60,000 square miles of dead fish, and estimated the tonnage as great enough to equal the entire world's commercial catch for a year! All because the current had goofed off.

AT THE Woods Hole Institution of Oceanography, Dean Bumpus, who recently completed a special study of Canadian waters for the fishing industry, threw new light for me on Nature's way in the sea. Cod eggs are not cast adrift at random, but in a current that carries them toward Newfoundland. The timing is precise. The current regularly brings the eggs over the rich feeding grounds there at exactly the time when the young are ready to hatch and dive straight down, seeking a safe bottom.

Every now and then, the winds in the cod country take on an unusual set, and the current in which the eggs float is speeded up. None of the sprats in them will survive. By the time they break

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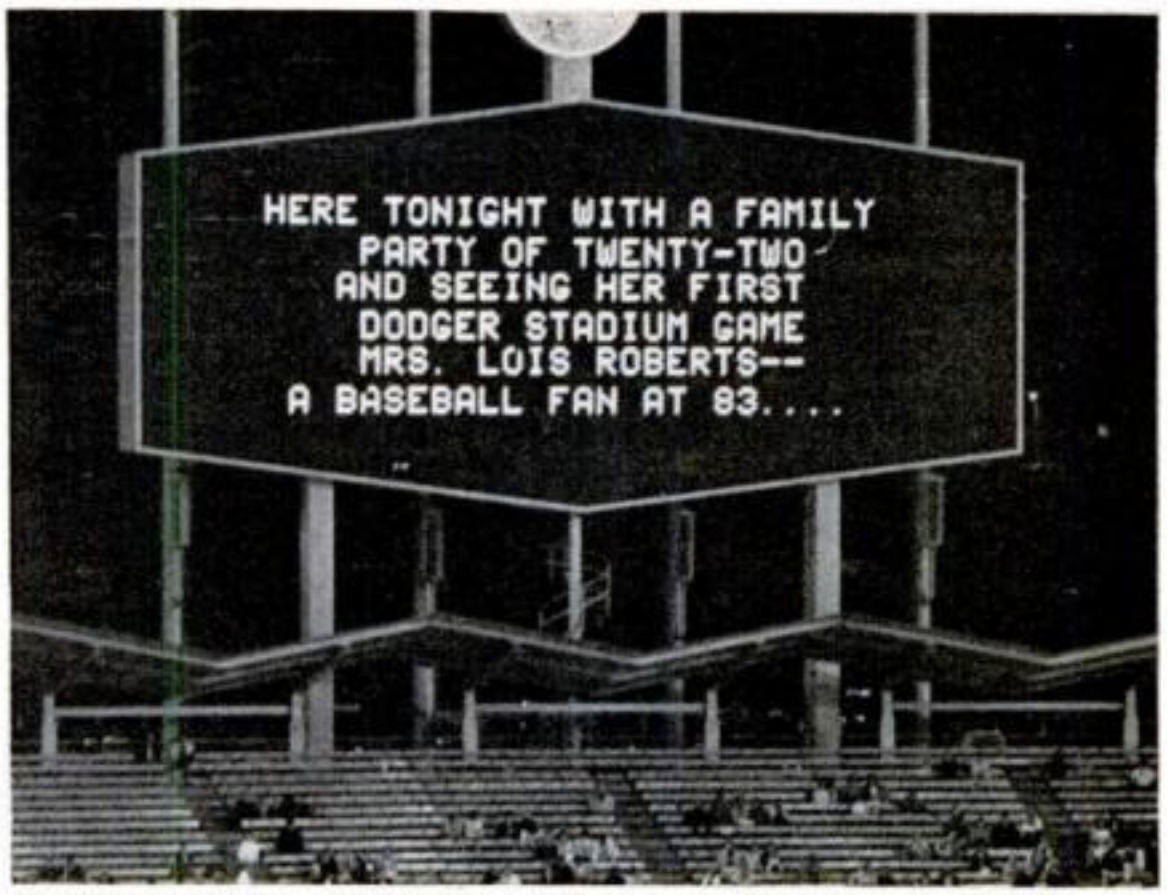
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Knock-down tower for Florida beach

This 125-foot steel observation tower was assembled in sections like a child's Erector set and is designed to be taken down the same way. Reason: The site it stands on was leased for only 12 years.

Built to withstand hurricane winds up to 165 m.p.h., the tower has a foundation of 16 concrete pilings, each 50 feet long. It's situated near the ocean at Daytona Beach, Fla.



Announcements, messages, and slogans show up in lights over left-field stands to keep things lively at Dodger Stadium.

Pushbutton sign types its messages

Largest and most complex announcement sign in a baseball park, a 34-by-75-foot electronic bulletin board is displayed over the left-field stands at Dodger Stadium in Chavez Ravine, Los Angeles. Its messages—up to eight lines, with 31 three-foot-high electrically lighted letters in each line—can be read far away from the park.

The board is controlled from a console in the stands. The operator can use any row or rows; flash a message letter by letter, row by row, or all at one time; and also make erasures. Messages may be preset on tape before a game or the season, or they may be typed in lights directly from a special typewriter.

A scoreboard of the same size shows the game's progress in right field. It is operated from a separate console.



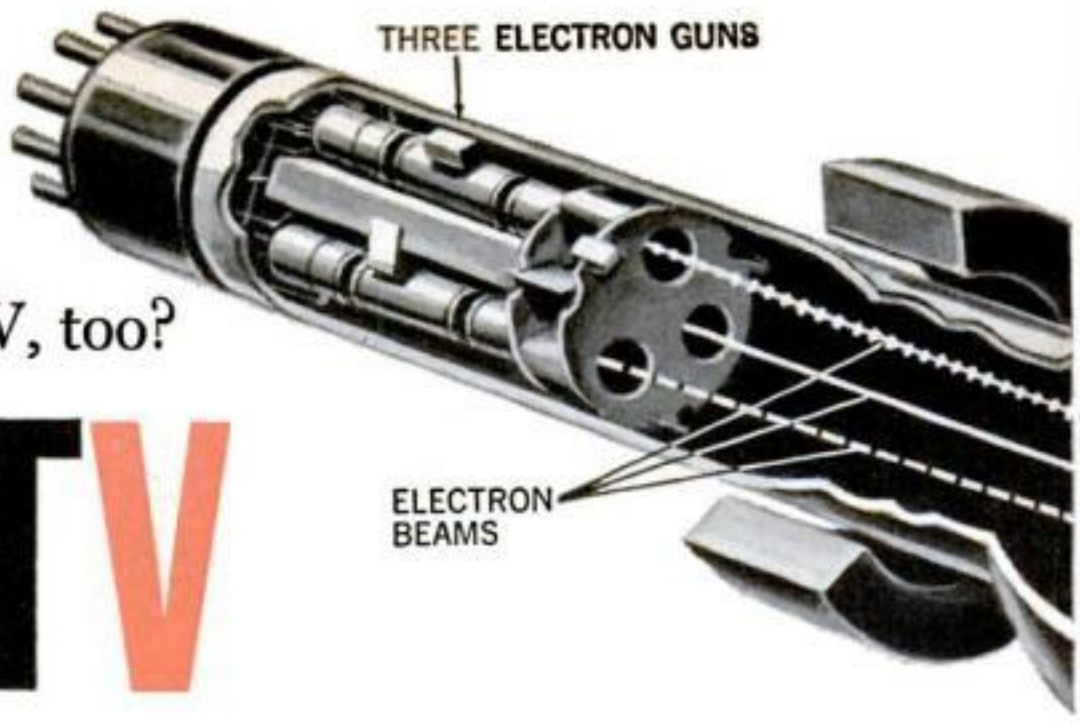
Messages in lights may be typed directly or taken off tape on control board at right. Console at left posts the score.

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With a variety of sets to choose from, and lots of color programs, is it time for you to go to color TV, too?

COLOR TV

Is It Finally Worth the Money?



By C. P. Gilmore

COLOR television—launched with a resounding thud almost a decade ago—is finally coming alive. Signs of its new vitality:

• More than a million color sets are now in American homes. Last fall's installation rate of 5,000 new sets a week will double before the end of this year, should double again in 1964.

• Where a few years ago only one company, RCA, was making color sets, now every major manufacturer has a color line.

• Color programs are plentiful. NBC—long-time leader in color programing—now airs three-quarters of its night-time schedule in color, and sprinkles rainbow-hued shows throughout the daily schedule from early morning to late night. ABC started color programing this season. And CBS—only present holdout—will have to follow suit soon. More than 300 local stations transmit network color shows, more than 100 broadcast color movies, 50 have facilities for local live color programs. Of these, a few—WLW in Cincinnati, WBAP in Fort Worth, WGN in Chicago, for example—broadcast all their local programs in color.

With so much color on the air, I decided to take the big plunge a few months ago. When the set was delivered, I was a bit skeptical, I admit. But it didn't take long to make a believer of me. When the color is good—which is most of the time—it is spectacular.

After my wife and I got used to adjusting the color, there was none of the unnatural, garish, too-bright effect we thought there might be. The color, in fact, is usually so natural that once the novelty has worn off you frequently aren't conscious of it at all. It's the black-and-

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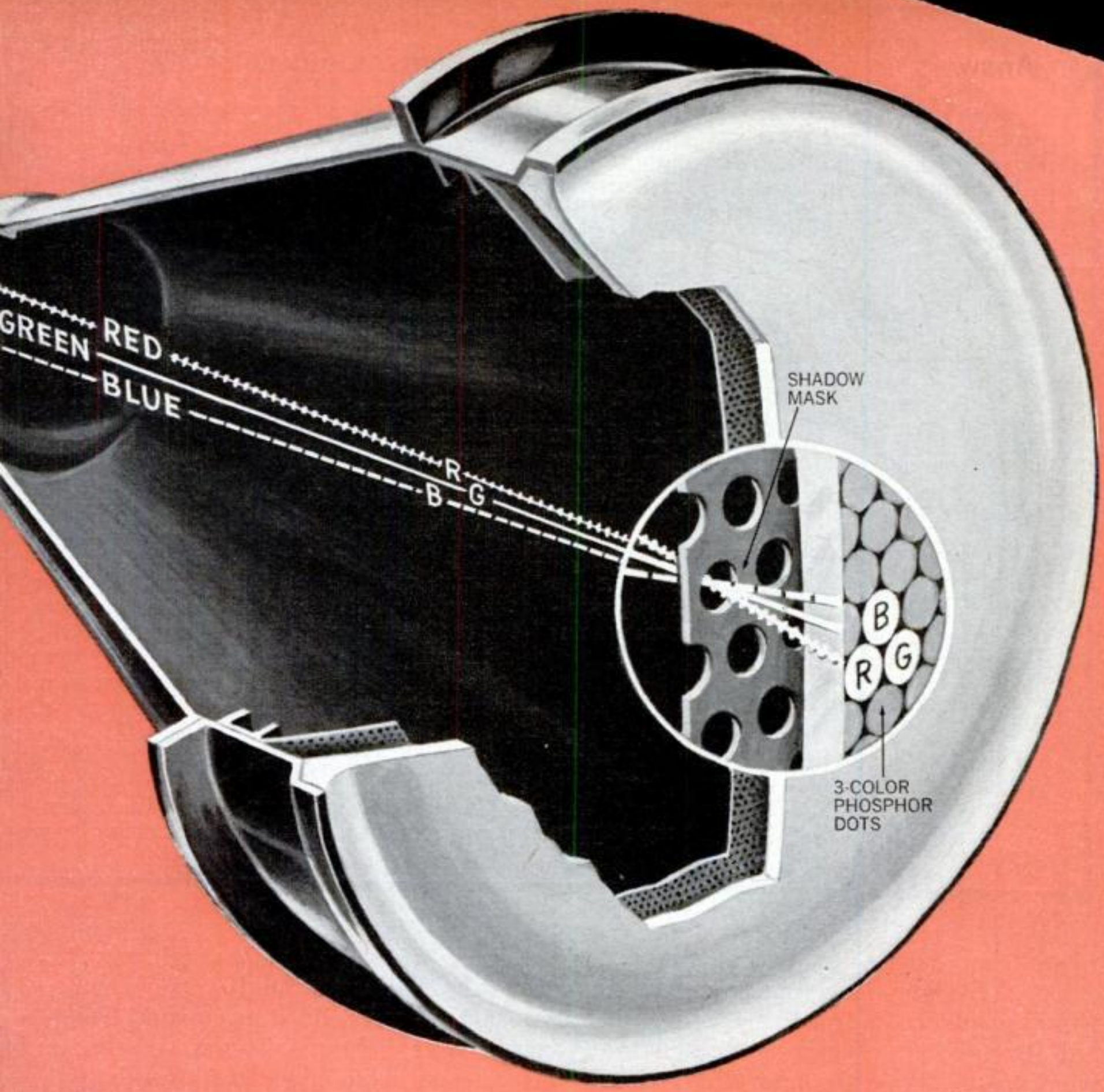
Shadow-mask tube used by all present color-TV sets

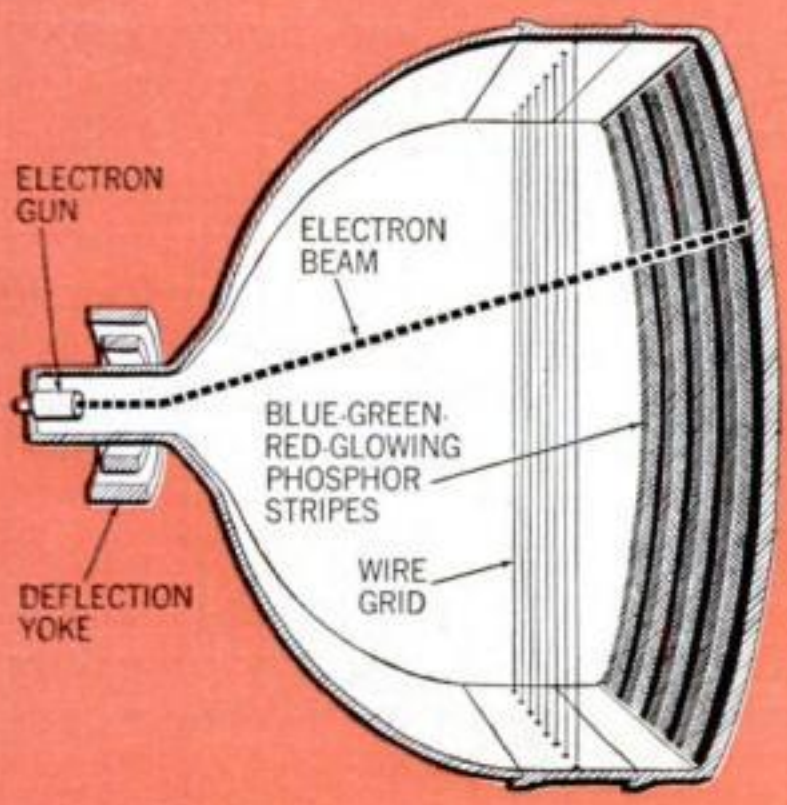
The standard color-TV picture tube is really three picture tubes in one envelope. Inside, between the three electron guns and the screen, is a flat plate with hundreds of thousands of tiny holes—the shadow mask. In line with each hole in the mask is a cluster of three phosphor dots on the screen. Each phosphor in the triad glows with a different primary color (red, green, or blue) when hit by the electron beam. Thus the beam from each gun paints an independent picture. You see the combination as a color picture.

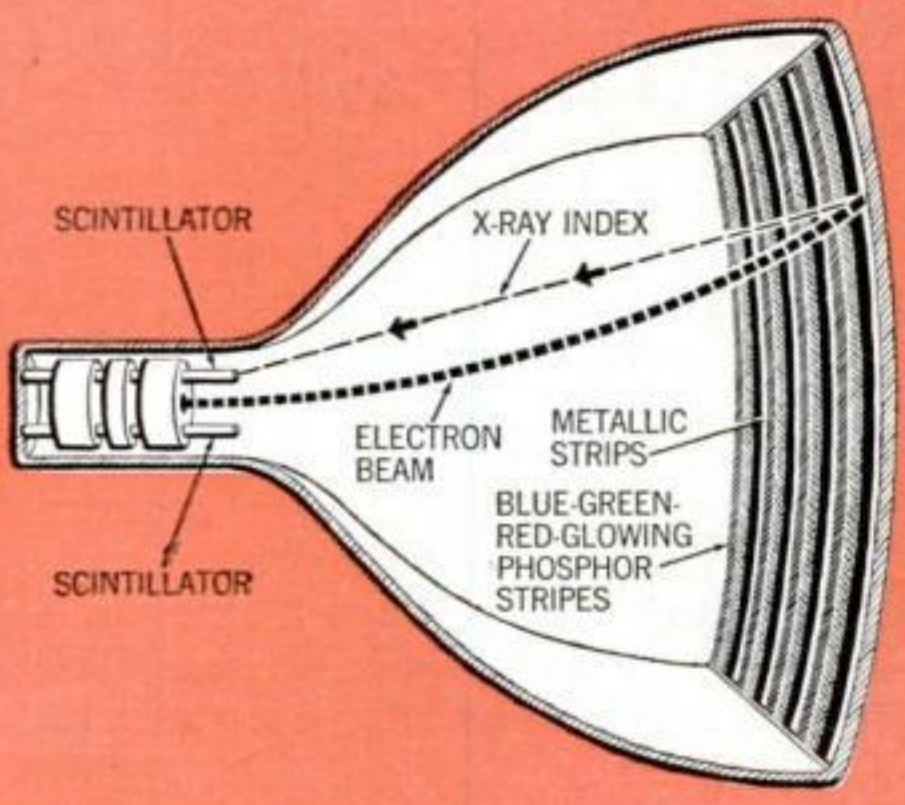
Two promising experimental color tubes

Chromatron tube (left) uses a fine wire structure rather than a shadow mask to direct electron beam. Charge on wires deflects beam to hit proper color-phosphor strip as beam sweeps across screen. (Drawing is made out of scale to clarify details.) Goodman tube (right) uses repeating groups of vertical color strips (red, green, blue) separated by metal indexing strips. X rays, given off when electron beam hits metal strip, trigger rapid gating circuits that insure registry of different color signals on the television screen.

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GREEN
RED
BLUE
R
G
B
SHADOW MASK
B
R
G
3-COLOR PHOSPHOR DOTS


ELECTRON GUN
ELECTRON BEAM
BLUE-GREEN-RED-GLOWING PHOSPHOR STRIPES
WIRE GRID
DEFLECTION YOKE


SCINTILLATOR
X-RAY INDEX
ELECTRON BEAM
METALLIC STRIPS
BLUE-GREEN-RED-GLOWING PHOSPHOR STRIPES
SCINTILLATOR

ers to the most-often-asked questions about color TV

People who have conquered their qualms and bought color TV generally have no regrets, I have found. But what of those who are tempted, yet have not taken the plunge? What are their misgivings? What do they want to know? To find out, first-hand, I did some eavesdropping in two of the nation's largest showrooms—one run by RCA, the other by Zenith. Here are answers to the questions that I heard most frequently.

1. Is color TV perfected yet?

Yes. It works and works well. Colors are clear and vivid. It can't make a lousy show good, but it certainly adds an extra dimension of beauty.

2. How consistent is the color?

On any one station, it's likely to be fairly consistent. Live programs are usually stunning, tape good, and film sometimes good, sometimes bad.

3. Is it hard to adjust for good color?

No, but it is a little more complicated than black-and-white. Tuning is more critical—but once you adjust fine tuning on each channel, you don't touch it again. The two knobs that control color may require minor adjustment when you change channels.

4. How is the quality of the black-and-white picture?

Inherently, because of the design of the tube, the picture can't be quite as sharp as it is on a regular black-and-white set. But the difference is minor.

5. Is service expensive? Do color sets need more service?

A first-year service contract in most parts of the country costs about $10 more for color than for black-and-white—around $69.50 as opposed to $59.50 (this varies from area to area). But there are rumors that the charge may soon be the same.

The color tube, of course, is the expensive part, and this is guaranteed for the first year. The color service contract for the second year goes up more than the black-and-white contract, since the color tube is three or four times more expensive. Life expectancy is roughly comparable.

6. How much better are the expensive sets?

The picture isn't any better. Each company makes only one color chassis. Price

white that begins to look unnatural.

Color TV, now firmly entrenched, has won acceptance only after a long, uphill struggle. For years it seemed impossible to break through the vicious circle: Few sets were sold because they were so expensive—but they couldn't be made to sell for less until the demand warranted quantity production. With few sets in use, TV stations couldn't afford to broadcast in color—but with few color programs to watch, few customers would buy sets. If it had not been for the determination of RCA Board Chairman David Sarnoff, in fact, color TV might have gone the way of 3-D movies and the steam automobile.

The green monkeys. When commercial television came on the scene right after World War II, Sarnoff threw millions into color research. But in 1950, when the FCC decided to set standards for color transmission, he still wasn't ready. RCA demonstrated a system, but the show wasn't wildly successful. Said Sarnoff later, "The monkeys were green, the bananas were blue, and everybody had a good laugh."

A system proposed by CBS, involving a large rotating disk, got approval. It was clumsy, but it did produce good color pictures. Main shortcoming: The system was not compatible. It couldn't receive regular black-and-white pictures. The country would need two completely separate TV systems—one transmitting in color, the other in black-and-white.

Even after the FCC's decision apparently ended the matter, Sarnoff poured millions into developing a workable, compatible system in which color could simply be added to the present programs. Finally, in 1954, an industry committee drawing on the work of RCA and a num-

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differences come in the extras: remote tuning, more and larger speakers, more expensive cabinetwork.

7. Will I need a new antenna?

Depends on the picture you get now. If your picture is strong, clear, and ghost-free, you'll get beautiful color. But small imperfections that may not bother you in black-and-white are more prominent in color. Best bet is to try color in your home. Most dealers are happy to give you a free home trial.

8. Can I move it around? Mount it on a swivel base?

It's not a good idea. Color tubes are sensitive to magnetization, and a set being moved may become magnetized from the earth's magnetic field.

A magnetized screen is blotchy. Part might be pinkish, another greenish. It's easy to remedy, though, by a process called degaussing.

9. When will sets be as compact as black-and-white sets, and when will larger tube sizes be available?

In the spring of 1962, RCA announced that a new 90-degree tube would be available for the 1964 models. (Current sets use 72-degree tubes. In a 90-degree tube, the beam fans out at a greater angle to cover the tube face, so that overall length of the tube can be shorter.) Last November, however, the company said the tube still wasn't good enough, and there would be 9-15-month delay. Motorola expected to have its 23-inch rectangular tube on the market in 1962, but didn't make it. At this writing, there have been no further announcements.

The new tubes won't make color sets as small as black-and-white for a given screen size (many of the black-and-white receivers now use 110-degree tubes), but they will help. RCA's 90-degree, 21-inch tube, for example, will reduce the present 26½-inch minimum set depth by about five inches.

10. When will color become cheaper?

The $500-and-up price tag (Sears, Roebuck has a set in the $450 range) is determined largely by the color tube. It costs more to begin with, and takes a larger, more expensive cabinet. Size, of course, will eventually come down, and price will fall with it.

Foreign competition may help, too. A 16-inch Japanese set built by Toshiba has been demonstrated in this country and is scheduled to go on sale this fall. Its price has not yet been announced.

ber of other companies that had been active in the field demonstrated a compatible system to the FCC. The CBS system was thrown out by the FCC and the present system adopted.

RCA factories started producing sets immediately. But it was a money-losing proposition. With a 15-inch tube and a $1,000 price tag, the sets simply didn't move.

For four years, color TV couldn't get off the ground. RCA produced a 21-inch color tube and gradually lowered prices to about $500 for the cheapest set. By 1961, sales had climbed to 200,000. With Sarnoff apparently winning his 130-million-dollar gamble, other makers moved in and started making sets. A big boost came that year when Zenith, biggest maker of black-and-white sets, announced a complete color line.

RCA's glowing dots. RCA's shadow-mask tube—the gadget that launched the age of color TV and is still in use in all color sets—is a marvel of ingenuity and engineering skill. It uses three electron guns, each carefully aligned to shoot a beam of electrons so that it hits only certain tiny spots of phosphor on the face of the screen. The gun that produces red, for example, can hit only the red-glowing dots, and is masked from the blue- and green-glowing dots by the shadow mask. The three beams sweep across the screen together, each hitting only the dots intended for it. When all three beams are of equal intensity, the three colors blend to create a black-and-white picture.

The trick in making the shadow-mask tube is one of alignment. As the beams sweep from side to side and top to bottom, the relationship between each beam

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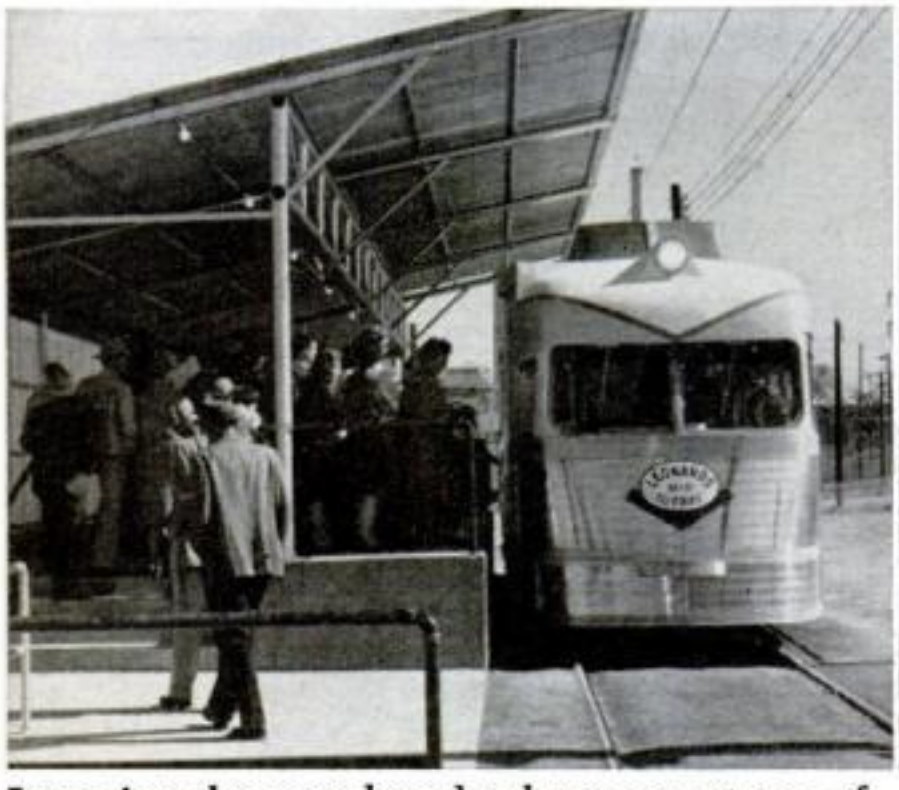


Apollo suit tested for wear on moon

Development tests are under way to provide U.S. astronauts with lunar space suits.

The scientist shown here measures oxygen consumption and metabolic rate while doing light tasks in an experimental pressure garment. The padded clothespin on his nose forces him to breathe through his mouth.

Studies are conducted in Republic Aviation's space-environment chamber for International Latex, which will make the final Apollo suit.



Incoming shoppers board subway car at one of three surface stations located in parking lot.



Railway runs from parking lot to store. Surface track is solid, subway is dotted line.

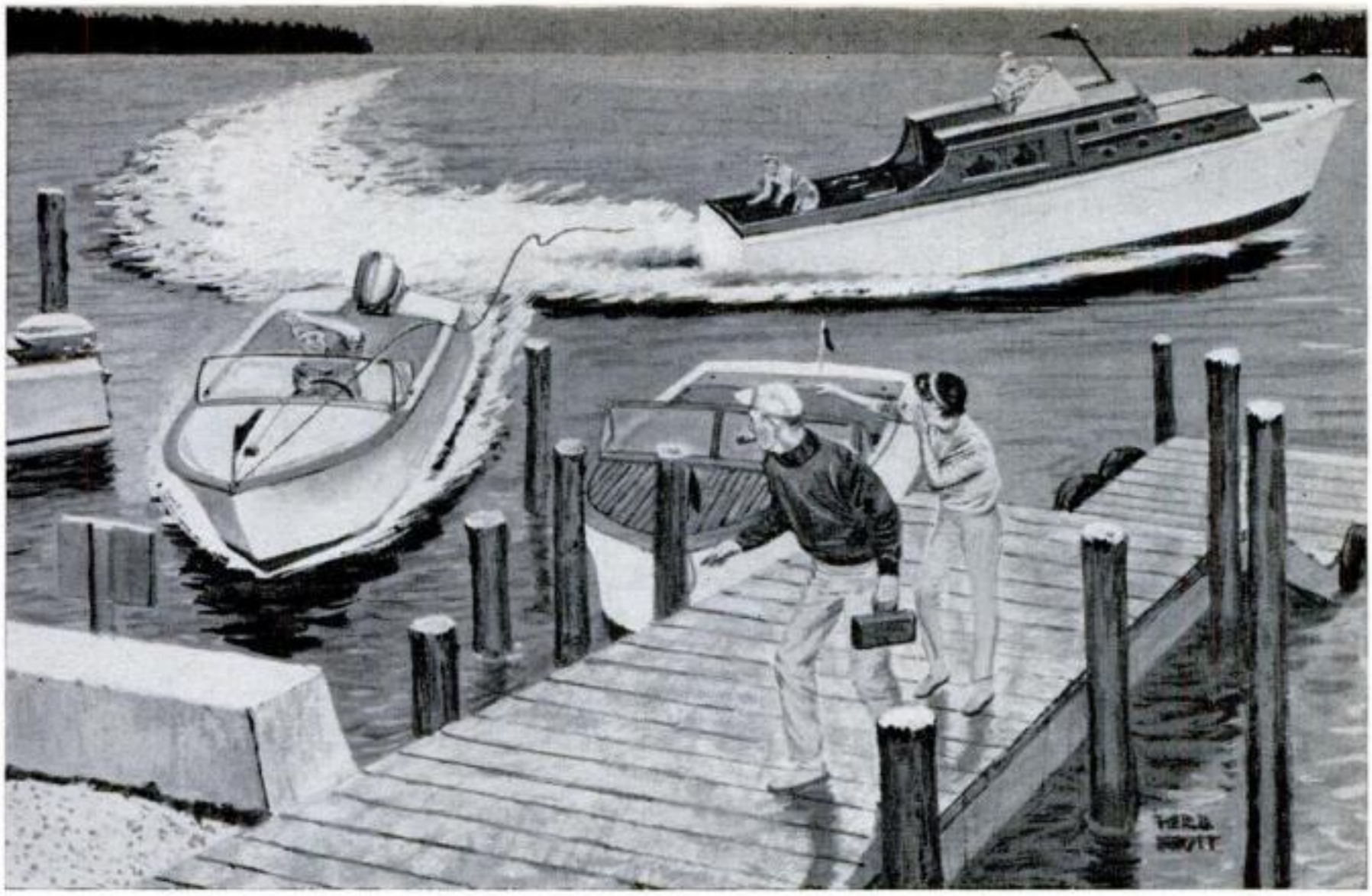
Free subway for shoppers

To combat traffic congestion and lure customers back from suburban shopping centers, a Fort Worth, Tex., department store has built its own subway.

The mile-long double-tracked line, three blocks of it underground, runs from a 14-acre, 5,000-car parking lot to the basement of Leonards Department Store. Rolling stock is five old streetcars reconditioned with stainless-steel sides, new seats for 100 riders each, and air conditioning. Each is powered by four 55-hp. DC motors.

The project cost $750,000, but no fare is charged, and riders aren't obliged to patronize the store. Generally increased business is expected to pay the tab.

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PS BOATING

What Did They Do Wrong?

HE HAD a sharp, new runabout, but when the motor died in the middle of a Wisconsin lake he couldn't start it. He tried hailing a big express cruiser as she roared past and he was surprised and grateful when she cut her speed, circled, and came alongside. He was embarrassed and self-conscious because the skipper of the cruiser was Abercrombie and Fitch's answer for what the well-dressed yachtsman wears when answering the distress calls of inexperienced outboarders.

"Heave me a line and I'll tow you to your dock," came the command from the cruiser. The operator of the runabout complied by throwing the mooring line, which was fastened with an eye splice to the bow. The passenger on the cruiser secured the line. The skipper took up the slack and poured on the power. As he neared his dock, the speedboat operator wondered when the cruiser was going to cut him loose. He suddenly realized that the cruiser intended to cut in close to the dock and cast off the line as he swung out into the lake. He knew that he was coming in too fast and signaled frantically to the cruiser to cut him loose. When the cruiser cast off the line, the runabout headed for the dock, narrowly missed two boats moored there, and splintered her bow on a concrete bulkhead. What did this novice boatman do wrong?

Here's what:

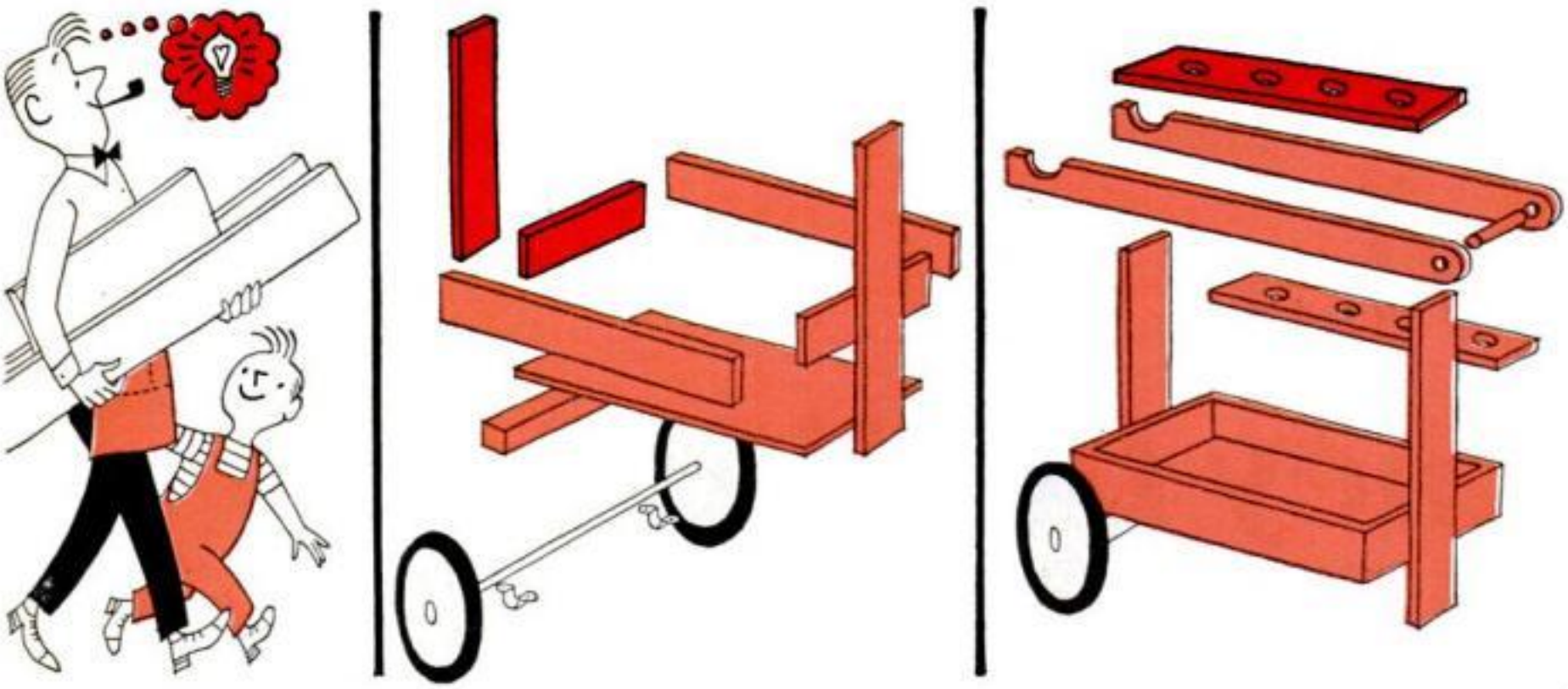
When he passed the line that was spliced to his bow, the speedboat operator yielded control of his boat to the other operator. In an emergency he was not free to cut loose at his own discretion. He should have used a line that he could snub on a deck cleat and cast loose from the cockpit. Or, having none, he should have requested a line for this purpose from the cruiser. With his motor dead, he became acutely aware that he had little steering control and no reverse for braking.—*Jim Liston.*

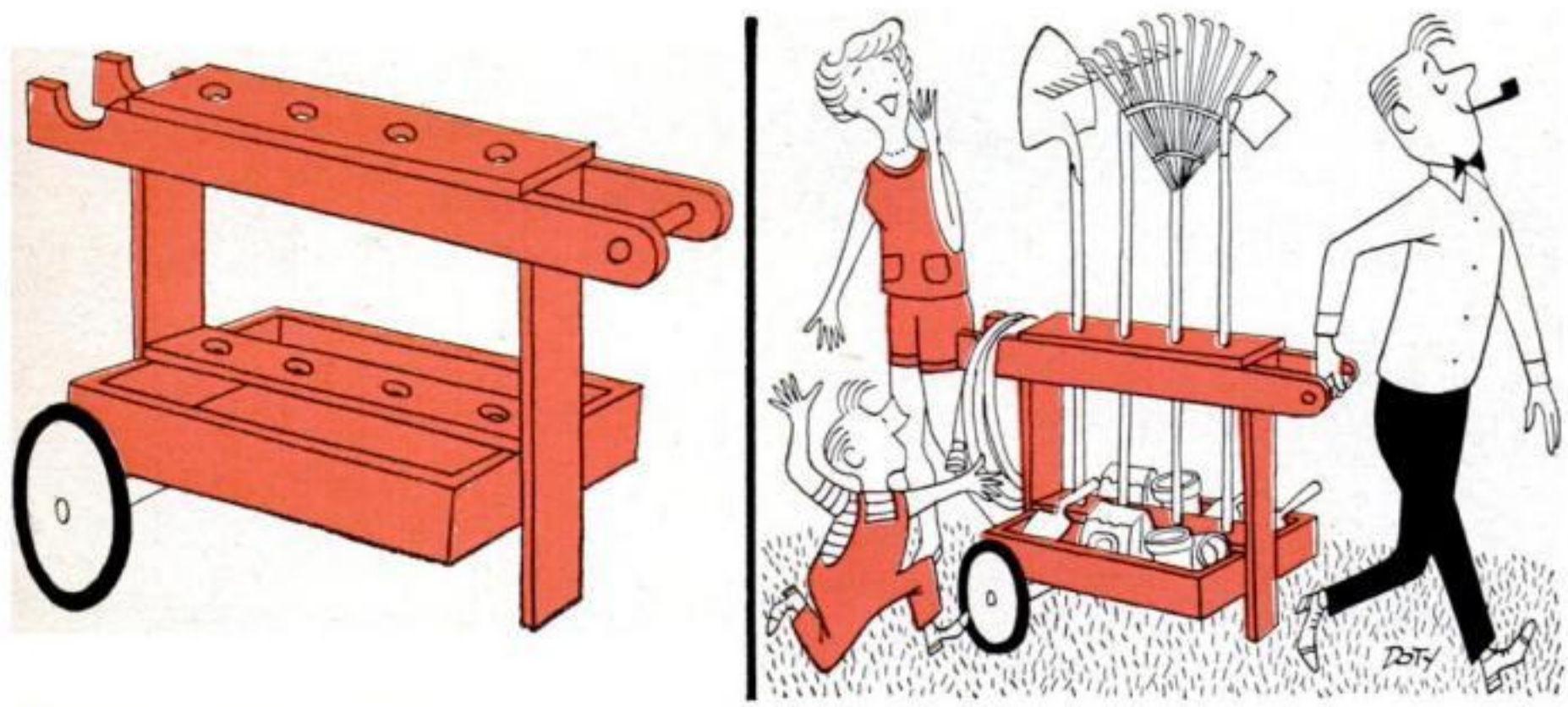
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Wordless Workshop

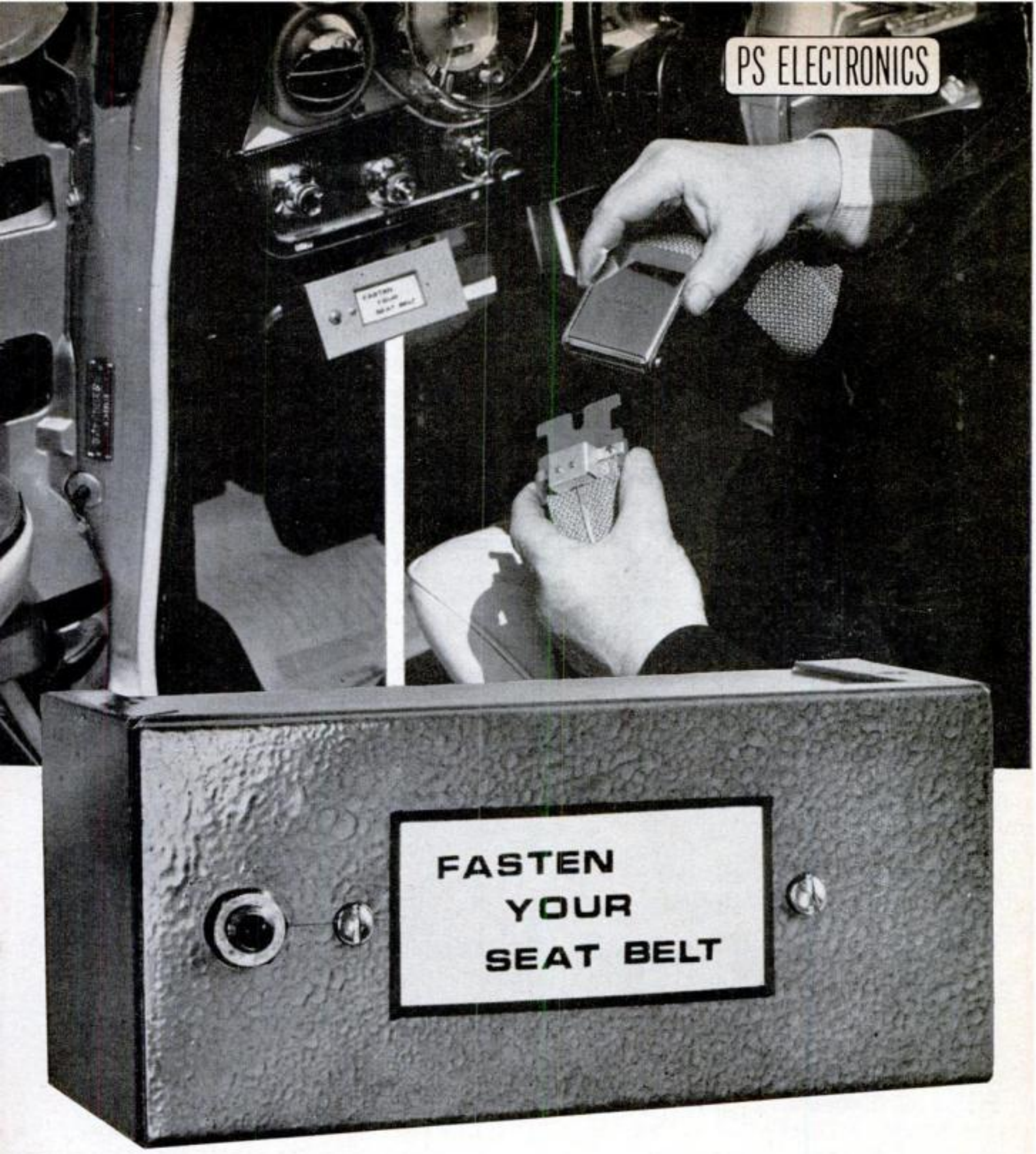
By Roy Doty and Paul Johnson







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...how to make an alarm for your car that reminds you

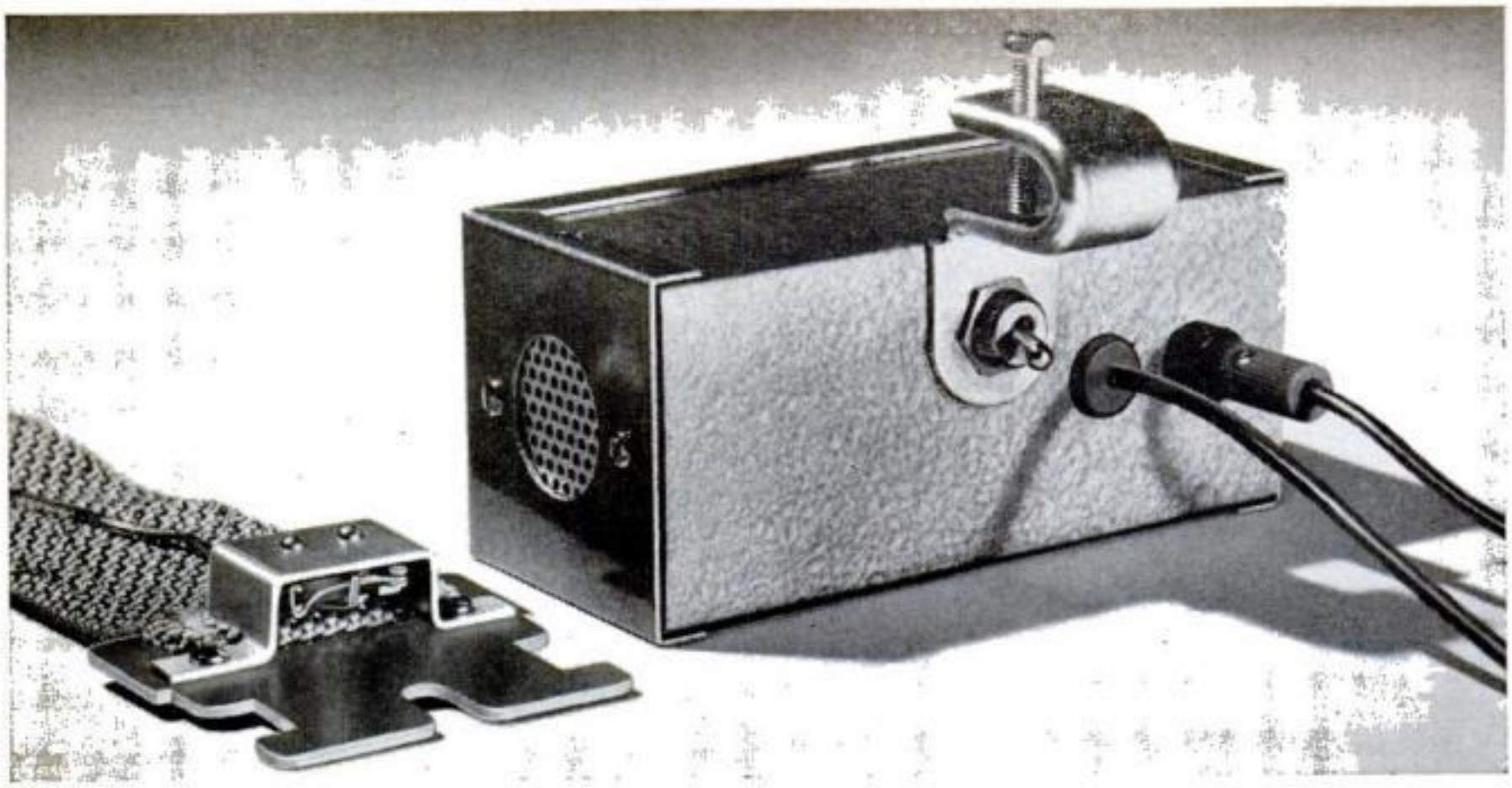
By Ronald M. Benrey

THERE'S just no arguing with the statistics—seat belts *do* save lives. But they can't help you if you sit on them. You've got to wear them. Here's an electronic reminder you can build for about $10 that won't let you forget to buckle down.

It is remarkably intelligent—and polite up to a point. After you turn on the ignition, you have 15 to 20 seconds to fasten your belt. If you don't get it done within that grace period, a sign lights up and a raucous scream—not even the most absent-

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Actuating switch for the seat-belt alarm can be mounted on the tongue of almost any kind of metal-to-metal seat-belt buckle. All other parts, including the loudspeaker for the audible alarm, are mounted in a small metal box that clamps under the dash of your car. Clamp and disconnect switch are a standard assembly that you can buy at auto-parts supply stores.

minded can ignore it—fills the car. Buckling the belt restores peace and silence.

You get a 15-second courtesy period if you have to unbuckle to fish a toll coin from your pocket; or you can intentionally gain a 15-second reprieve at any time by pushing the courtesy button on the front of the case. In either instance, the warning again sounds insistently if the belt is left unbuckled for more than the allotted grace period.

A simple transistor circuit and relay are the brains of the device. All parts, except the tiny snap-action switch attached to the buckle, are mounted in a Minibox. The box is supported beneath the dashboard with a screw-clamp mounting bracket.

Mount the snap-action switch on the tongue part of the buckle. Since there are nearly 50 different seat belts on the market, with a variety of buckles, you will have to use your ingenuity in adapting the switch to your particular buckle. Make an actuator of stiff wire (a large paper clip works well) and bolt it to the switch so that it will operate the pushbutton when the front edge of the buckle presses against it as the buckle engages. Bend a cover for the switch out of a piece of sheet aluminum.

Use miniature zip cord for the switch connection. Stitch it securely to the belt with carpet thread. Ground one lead to the car frame by soldering or clamping it to the seat-belt anchor bolted to the floor. Be sure it makes good electrical contact. Run the other lead under the floor mat to the alarm box under the dash. A banana plug and jack make the connection.

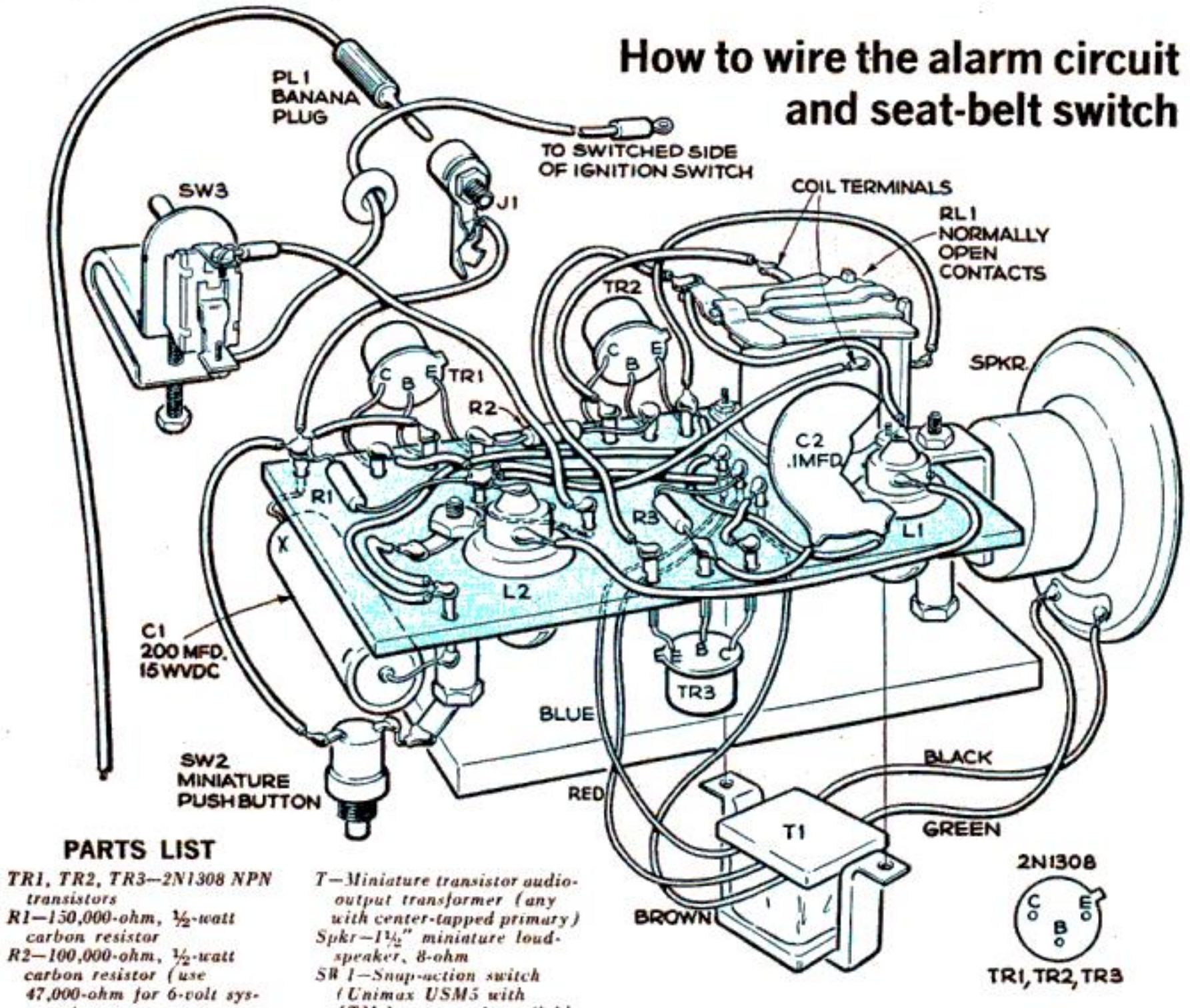
Most of the electronic components in the alarm box are mounted on a perforated chassis board. Push-in terminals (flea clips) serve as mounts and tie points. The arrangement of parts and wiring is not critical, but pay careful attention to the polarity of the capacitor connections and correct identification of the transistor leads. To keep soldering heat from damaging the transistor, hold leads with needle-nose pliers, to act as a heat sink, when you solder.

The two pilot-light bulbs that illuminate the "Fasten Your Seat Belt" sign are held in rubber grommets. Drill holes in the chassis board, insert rubber grommets, and force the bulbs into the grommets. They should fit tight enough to hold securely. Paint the sign on clear plexiglas. Mount it over an opening cut in the aluminum box. Glue a piece of white typing paper over the back to serve as a diffuser and produce an even white glow behind the sign.

Connect a single insulated wire from the switch on the alarm box to the cold side of the ignition switch. The circuit shown is for 12-volt, negative-ground systems. If your car has a six-volt, negative-ground system, substitute the parts indicated in the parts list and wire the pilot-light bulbs in parallel. ■ ■

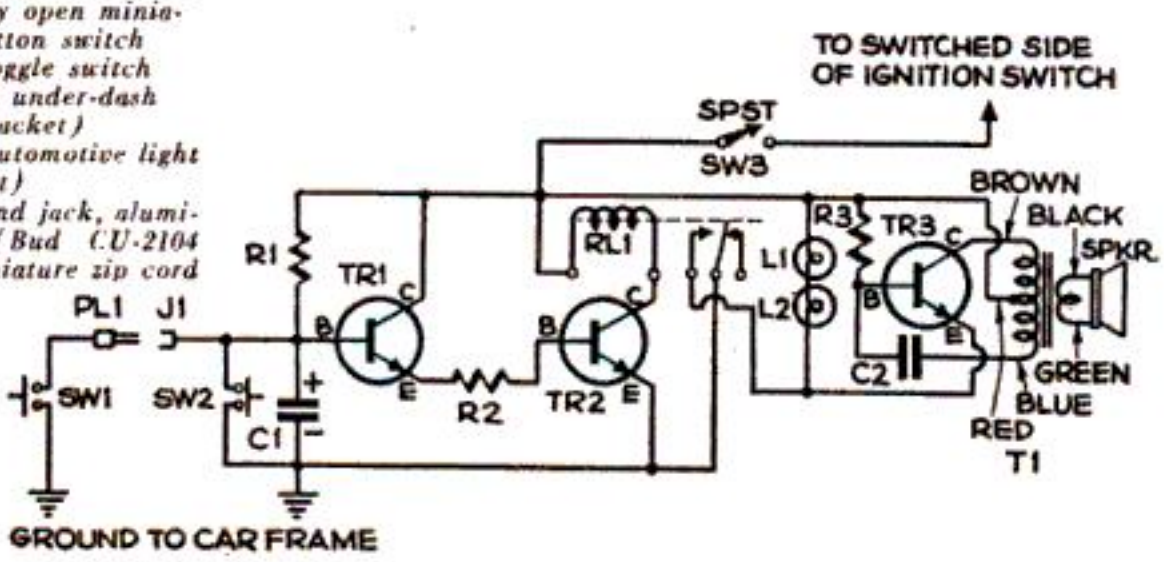
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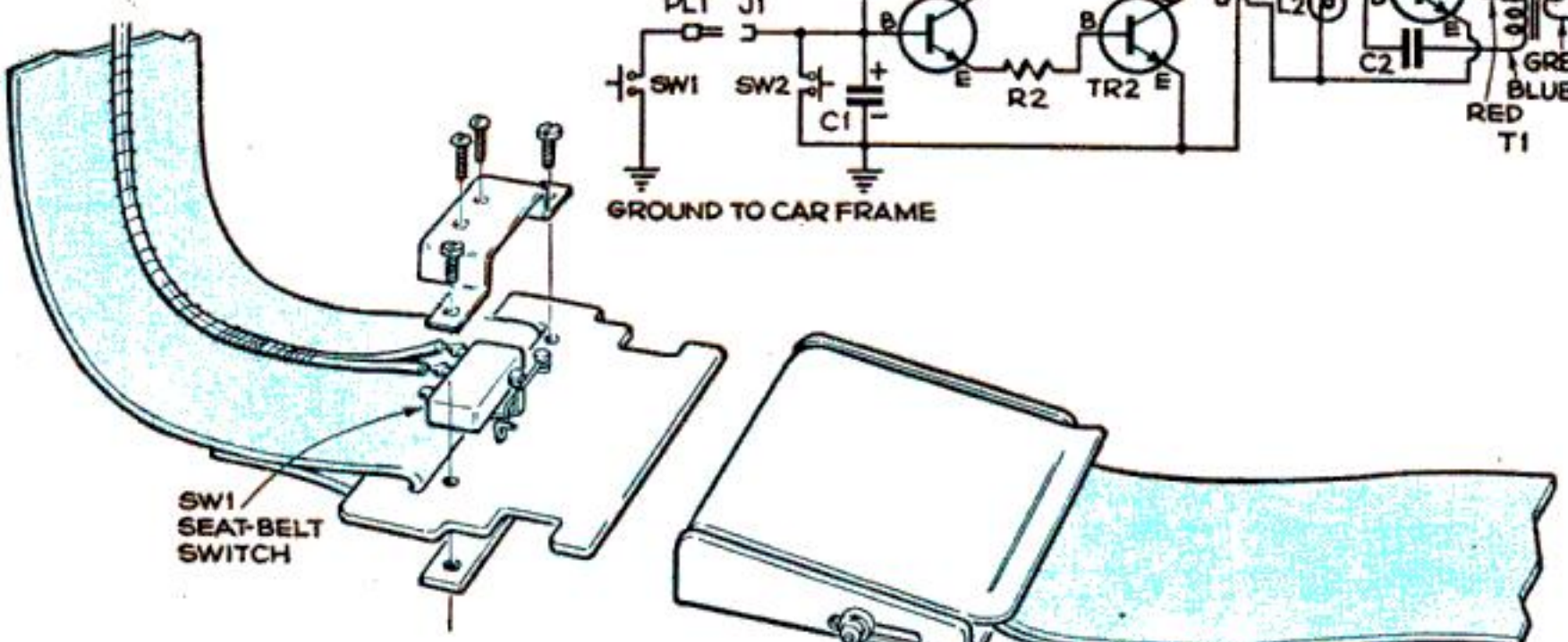
How to wire the alarm circuit and seat-belt switch



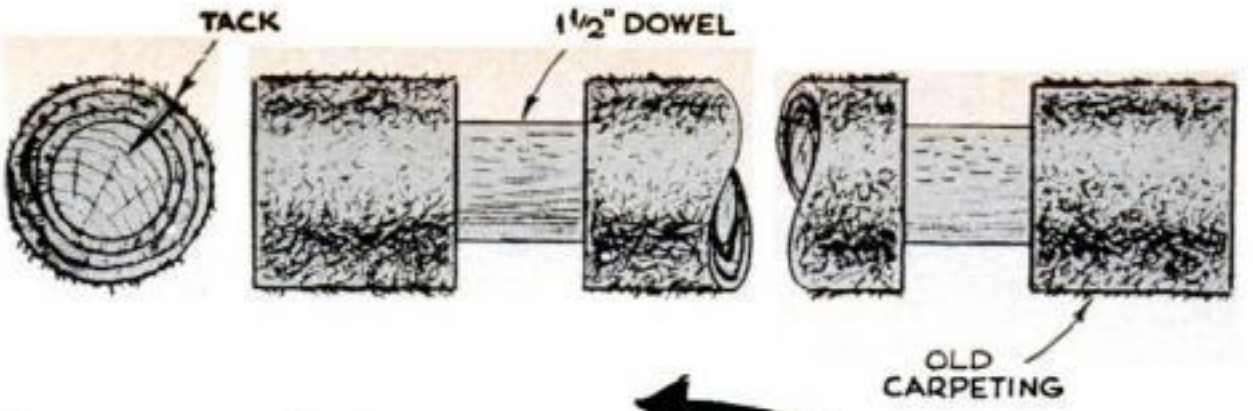
PARTS LIST

TR1, TR2, TR3—2N1308 NPN transistors
R1—150,000-ohm, ½-watt carbon resistor
R2—100,000-ohm, ½-watt carbon resistor (use 47,000-ohm for 6-volt systems)
R3—8,200-ohm, ½-watt carbon resistor (use 3,900-ohm for 6-volt systems)
C1—200-mfd., 15 WVDC electrolytic capacitor (Sprague TE-1164 or equal)
C2—0.1 mfd., 50 VDC, disk capacitor (Sprague TG-P10 or equal)
RL—6 VDC relay (Potter-Brumfield RS5D)
T—Miniature transistor audio-output transformer (any with center-tapped primary)
Spkr—1½" miniature loudspeaker, 8-ohm
SW 1—Snap-action switch (Unimax USM5 with ATM-1 actuator is available from Radio Shack, Boston)
SW 2—Normally open miniature pushbutton switch
SW 3—SPST toggle switch (comes with under-dash mounting bracket)
L1, L2—#51 automotive light bulbs (6-volt)
Banana plug and jack, aluminum box (Bud CU-2104 A), and miniature zip cord



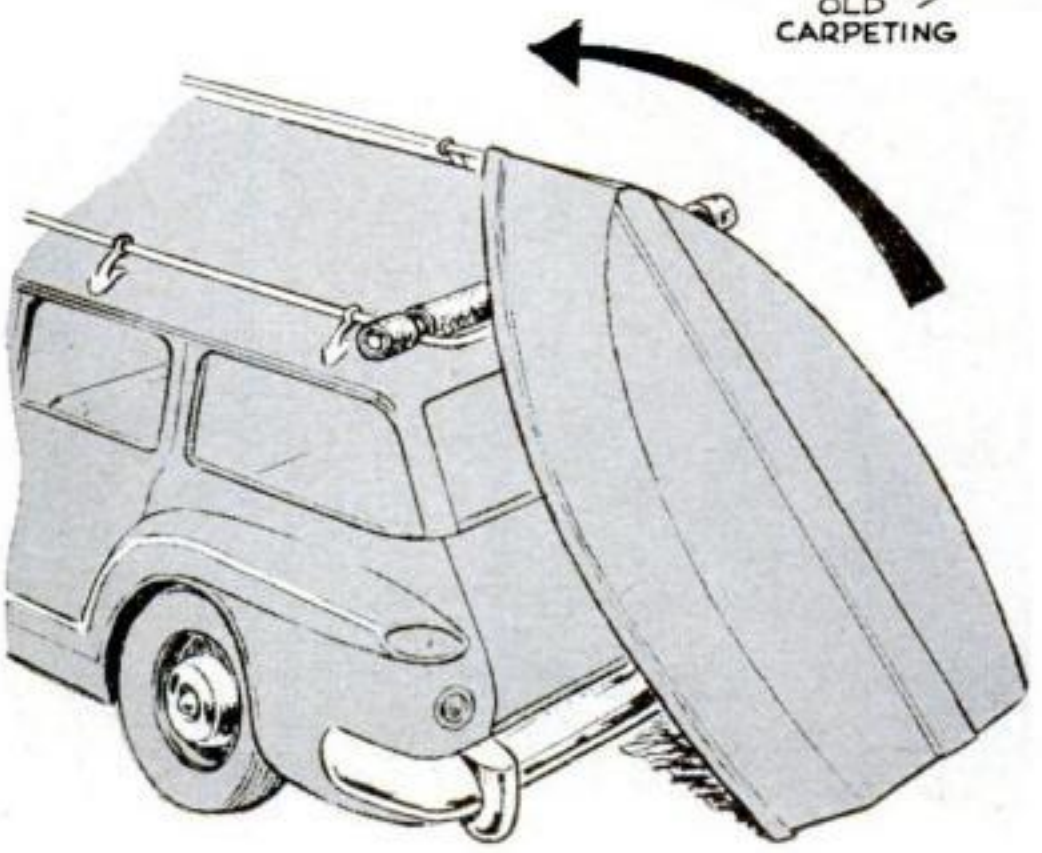


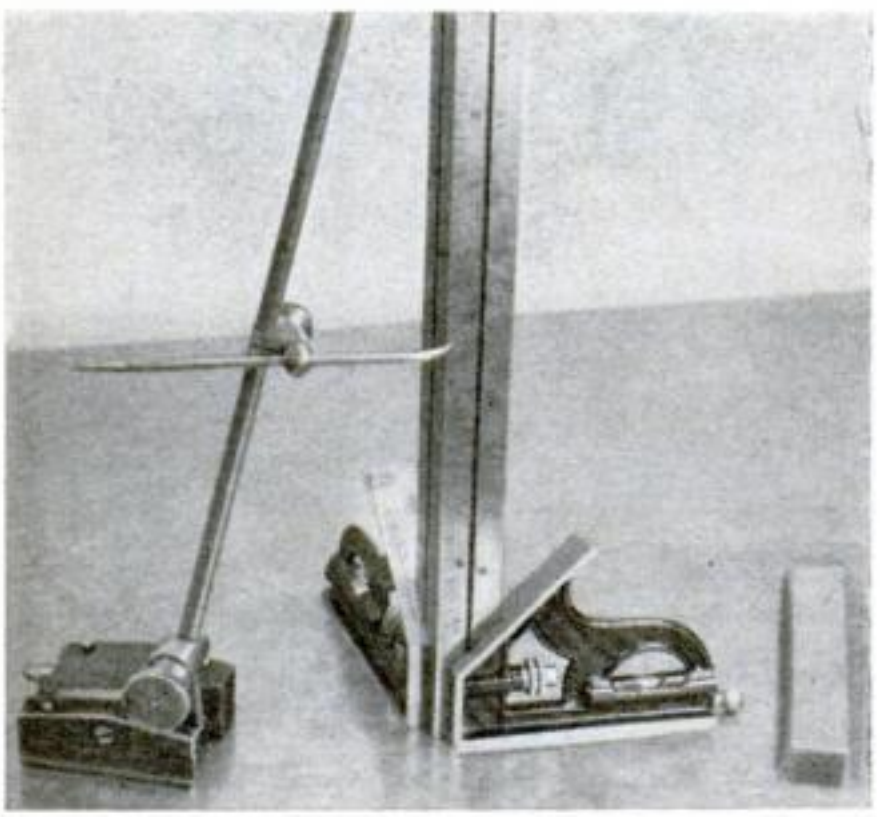
Short Cuts and Tips FROM PS READERS



Roller helps mount boat on car top

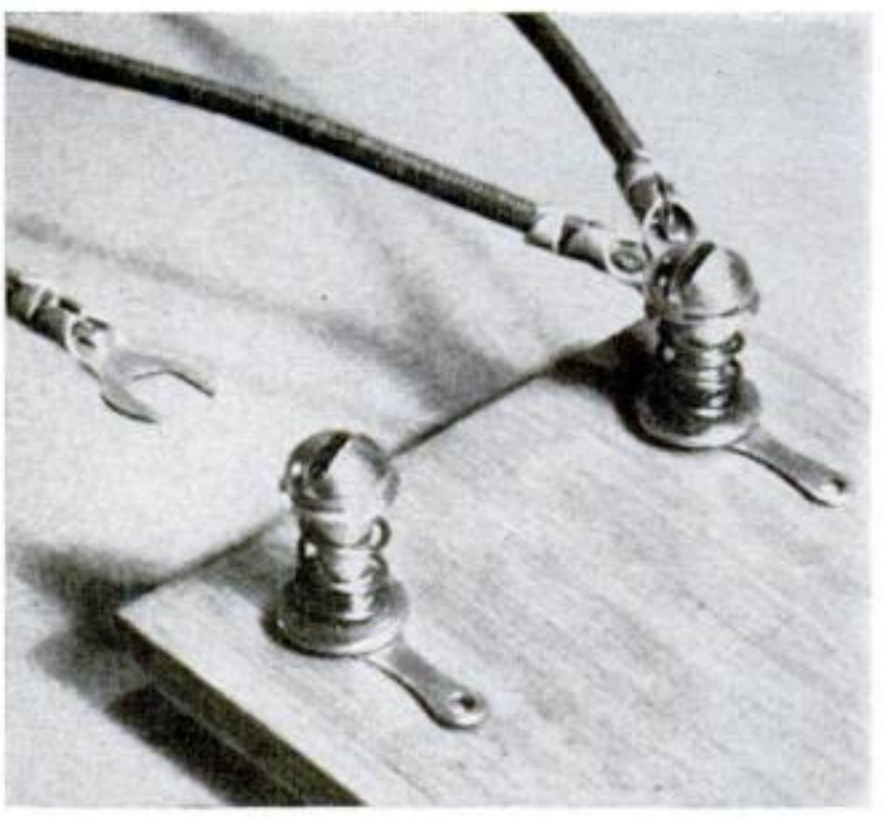
After struggling to lift my small outboard onto the top of my station wagon, I got this idea: Over a 1½" dowel slightly longer than the width of my rooftop carrier, I wrapped and tacked old carpeting, leaving two sections of the dowel uncovered to act as guides. With the dowel across the rear of the luggage rack, I can lean the prow of the boat over it, lift the stern, and roll the boat forward neatly into place.—*A. Weber, Edmonton, Alberta.*





Twin squares for surface-plate layouts

Layout measurements are often made on a surface plate by using a surface gauge to pick off the measurements from a combination square that stands upright on the plate. You can improve on this method. Instead of a single square, use a pair of squares soldered together at several points along their back edges. By attaching them in this way, you no longer need to hold the square in one hand while trying to adjust the surface gauge with the other.—*H. J. Gerber, Menomonie, Wis.*



Multiple-connector binding post

For instant contact-break multiple connections, I use this setup. It allows me up to 12 spade-lug connections on each post without crowding. I use brass machine or wood screws along with brass eyelets, 1½" springs, and washers. I make the binding post by slipping on an eyelet, spring, and brass washer and soldering the washer to the screw. To make a connection, I push down on the eyelet with a screwdriver and insert a lug under the screwhead.—*Robert Micals, Freehold, N.J.*

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How to get started in

SCUBA DIVING

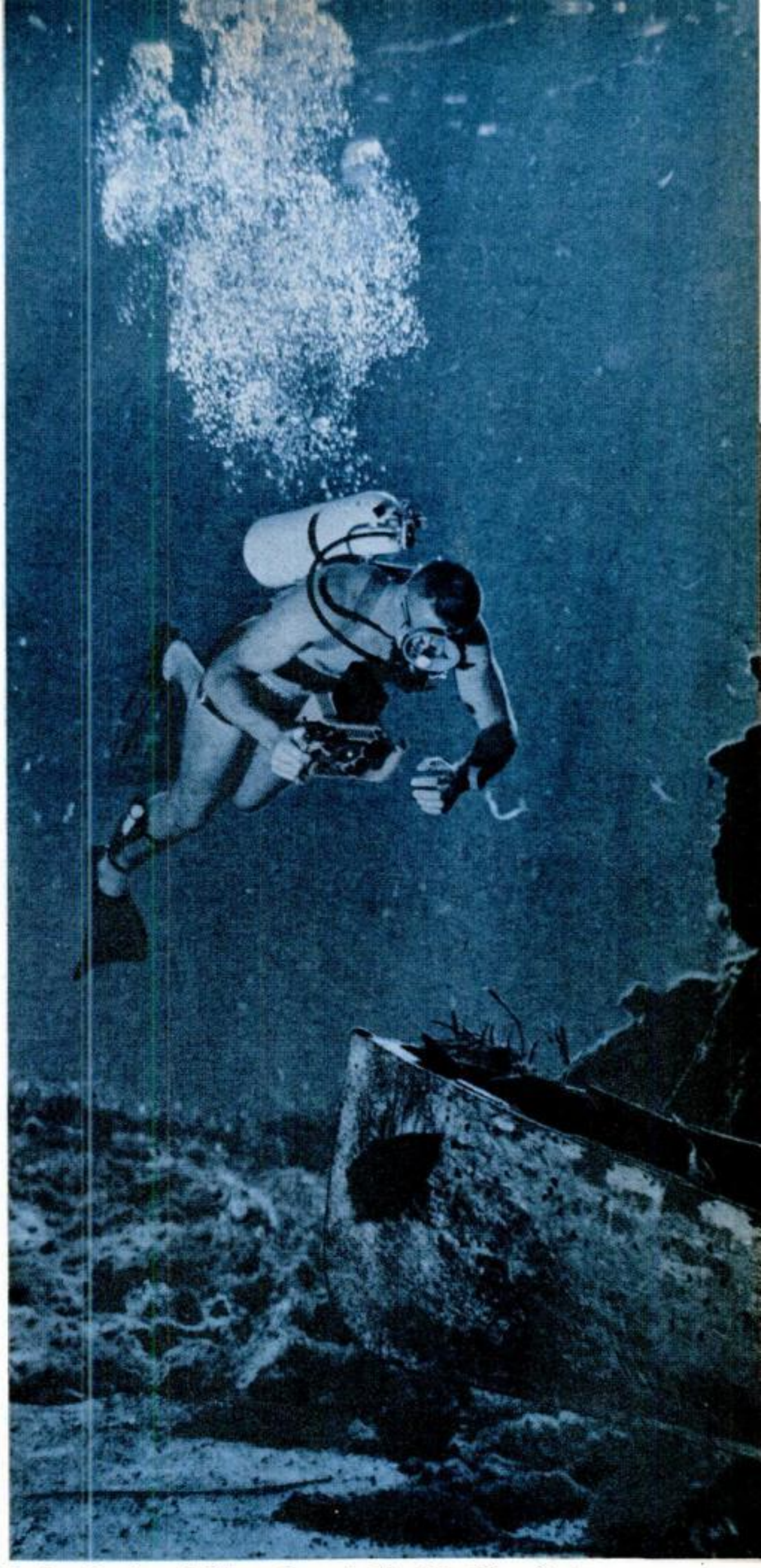
What do you have to know before you strap on an air tank and drop into the dark, mysterious world under the sea? Here's the low-down

By Everett H. Ortner

THERE'S a traffic jam at the bottom of the sea these days. The fish and submarines have been joined by a stream of skin and scuba divers who have splashed in to rubberneck at the scenery, scrounge around in old Spanish galleons, take snapshots of Mom sitting on a coral reef, or catch lunch at the end of a spear.

What's it like to strap on a lung, slip a mask over your face, put fins on your feet, and head down under the water? I tried it, and I can tell you that it's like nothing you've ever experienced. The ability to move in any plane—go up or down, bank like a seal, flip like a porpoise—is exhilarating. The sense of physical freedom makes your body tingle. It's something that up to now only

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Exploration is a thrill—as here, in Florida's Silver Springs.

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the sea and air creatures have known.

And then there's the thrill of exploration, of peering into underwater caves, picking treasures off ships that went down hundreds and even thousands of years ago, mingling with schools of fish and perhaps reaching out to bump a grouper in the side (he goes *wroom-wroom-wroom* like a big bass drum). It's a strange, exotic world that'll make you feel like an astronaut on Mars.

There's a practical side to it, too, even for the amateur diver. College kids pick up summer earnings by unsnarling lines, unfouling props, and plugging leaks while the boat owner, topside, sips martinis, his yachtsman's cap and jacket dry. "Fish watchers," mobilized three or four times a year, sit on the sea floor to take a census of the fish for the federal government. Bounty hunters pick starfish off clam beds. Photographers have found a new, exciting background for pictures. Even the astronauts have to do it—it gets them used to that weightless feeling.

The Aqua-Lung. What has brought all this about? Two Frenchmen, Capt. Jacques-Yves Cousteau and his associate, Emile Gagnan, and an invention: the Aqua-Lung. Men have always plunged into the sea, and those with strong arms and stout lungs could get to considerable depths for short periods (the modern record is 200 feet with an underwater stay of 3 minutes, 35 seconds, set by a Greek sponge diver). But even the strongest arms and biggest lungs permit only the most limited work underwater.

For professional divers there have been answers: the "hard-hat" outfit—steel helmet, waterproof suit, air lines to a compressor on the surface—or "closed-circuit" lungs with a portable oxygen tank and rebreathing apparatus (for military use).

The Aqua-Lung put the amateur diver under the water. Its heart is a simple, cheap, and reliable device—the open-circuit regulator—that transmits air on demand, as the diver breathes, and at the same pressure as the surrounding water.

The pros—the salvage and construction men who earn their living underwater—have taken happily to open-circuit scuba, too. One veteran of 22 years of diving estimated for me that three-quarters of professional diving is now done with this gear.

Can anybody go scuba diving? Perhaps right now we'd better make a distinction that most serious divers make: between skin diving and scuba diving. Anybody who can



Four outfits: Two

1. Basic skin diver: Mares fins ($9.95); Mares snorkel ($1.95); Valor knife ($3.50); Swimaster Lifegard flotation ($7.95); Sportsways mask ($5.95); Sportsways flag ($7.95). **2. Basic spear fisher:** Voit Viking fins ($10.95); Voit 50 Fathom mask ($6.95); Champion Deluxe Arbalete spear gun ($27.50); Central Skindivers weight belt ($2.95) plus four two-pound

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put you on the water; two take you under

weights ($8); Mares Bello snorkel ($2.95); Central fish stringer ($1.95); U.S. Divers Vulcan knife ($6.50); Healthways thermometer ($3.95); Swimaster Lifegard flotation ($7.95); Central Shorty wet suit ($11.95); Sportsways flag ($7.95). **3. Basic scuba:** Central Constant "J" tank block ($85); Sportsways Sport Diver single-hose, two-stage regulator ($50); Stebco Mae West flotation ($12.95); Voit Giant Viking fins ($13.95); Mares Bello snorkel ($2.95); Sportsways flag ($7.95); Central nylon-lined wet suit and hood ($39.50); Swimaster Wide View mask ($12.95); Voit depth gauge ($7.95); Sportsways Commando knife ($8.95); Voit tank gauge ($9.95); Central weight belt ($4.95) plus five two-pound weights ($10).

For a complete scuba outfit, turn the page 93

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4. Complete scuba outfit: Central Constant "J" tank block ($85); U.S. Divers Aquamaster two-hose, two-stage regulator ($90); Nemrod Max-Vue mask ($14.95); Central "Navy" flashlight ($19.95); Central nylon-lined wet suit and hood ($39.50); Sportsways Commando knife ($8.95); Sportsways compass ($3.95); Healthways thermometer ($3.95); Central watch ($75); Nemrod depth gauge ($14.95); U.S. Divers decompression table ($3.95); Central gloves ($3.95); Voit tank gauge ($9.95); Stebco Mae West flotation ($12.95); Central boots ($3.95); Sportsways flag ($7.95); Aqua-Cam Mark I camera ($54.95); Voit Giant Viking fins ($13.95); Mares Bello snorkel ($2.95); Central belt ($4.95), five three-pound weights ($15).

swim can go skin diving. All you need are a mask for visibility, a snorkel tube (the familiar J-shaped pipe that enables you to breathe surface air while your face is underwater), flippers on your feet, an emergency flotation device (belt or vest), a knife, and a warning flag. With this *skin-diving* gear, you

[*Continued on page 148*]

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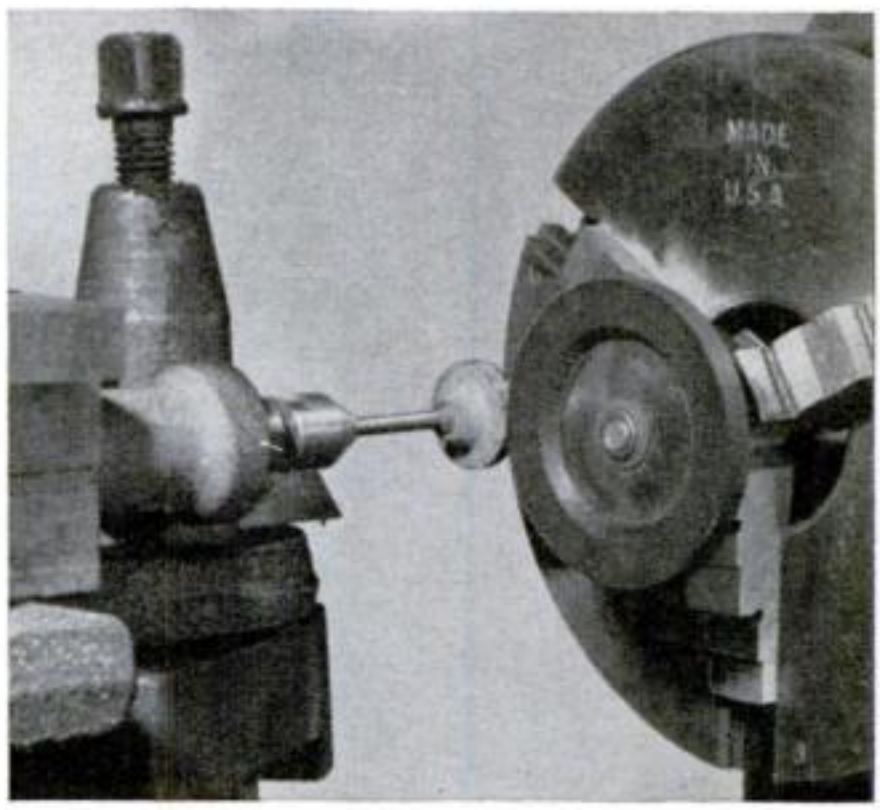
Short Cuts and Tips FROM PS READERS

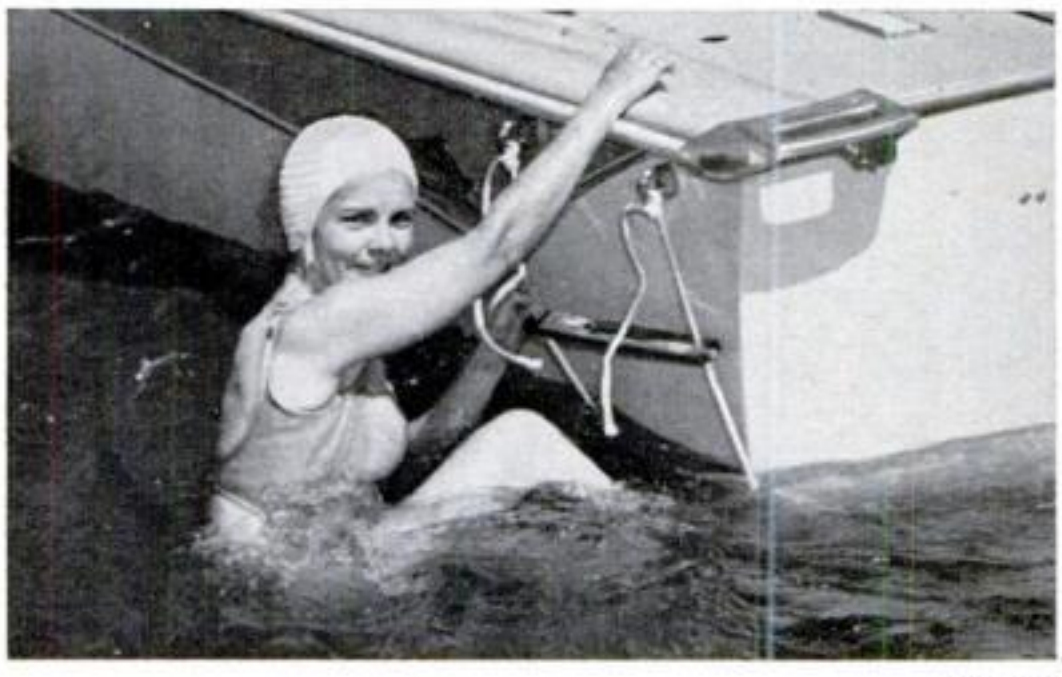
Tape-recorded bark guards house

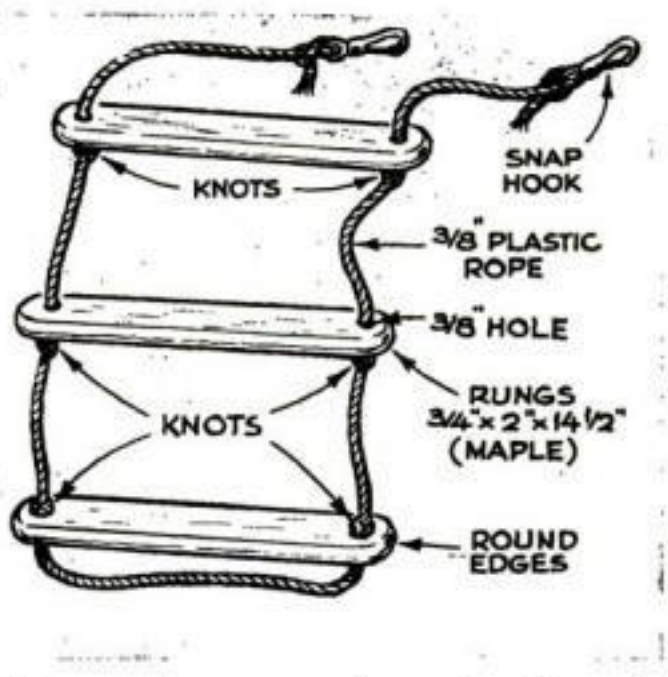
Not wanting to keep a large and menacing watchdog, I took my tape recorder to a neighbor's and recorded his dog's barks, yelps, and growls. Now at the least suspicion of prowlers we put our electronic dog on the hi-fi and turn up the volume. The recorded sounds are very convincing from outside.—*J. H. Matthews, St. Louis.*

Idler wheel ground true on lathe

"Wow" in a record player or tape recorder may be due to flat spots on the rubber-rimmed idler wheel. The wheel can be trued perfectly with a lathe and a hand grinder. Chuck a bit of rod in a lathe and turn it to a tight push fit in the idler shaft hole. Mount a hand grinder on the toolpost with wooden blocks or metal straps. True the grinding wheel with a scrap of a broken wheel. Running the lathe slowly, take the lightest cut possible, advancing the cross-feed only after several passes without advancing the wheel at all. There should be no shiny edges on the dull-black ground surface.—*H. Walton, White Plains, N.Y.*







Make your own inexpensive boat ladder

After losing two expensive rigid boat ladders I decided to make my own. This flexible one proved itself far superior in handling and stowing.

Make the three rungs from 14½" lengths of ¾"-by-2" maple or other hardwood. Round the edges and drill a ⅜" hole near each end to pass the plastic rope through. I attached snap hooks to the ends of the rope, so the ladder could be easily clipped onto two rings bolted on the boat's side (photo, left).—*M. Banister, Portland, Ore.*

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PS ELECTRONICS

Heat or Humidity?

How to make your own Discomfort Index Meter

By Ronald M. Benrey

DO YOU check the thermometer on a hot Saturday afternoon to help you decide whether you'll mow the grass or lie in your hammock sipping a tall cool one? Have you ever been fooled and found the weather unbearable after you cut the first swath—even though the thermometer reading indicated otherwise?

Here is an instrument that is a much more reliable guide to your probable discomfort than an ordinary thermometer. It measures both temperature and humidity, and computes the *discomfort index*. Building time: an hour or so.

The U.S. Weather Bureau defines the discomfort index (D.I.) by a simple formula: D.I.=4/10 (wet-bulb temp+ dry-bulb temp.)+15. According to their research, 10 percent of the population is uncomfortable when the D.I. reaches just under 70. About half of us are miserable at a D.I. of 75. And when the D.I. hits above 79, just about everybody goes limp.

The temperature-sensing elements in this electronic D.I. computer are glass-probe thermistors. One measures dry-bulb temperature; the other, wet-bulb temperature. Both thermistors are mounted on a strip of perforated chassis board. Two banana plugs, bolted to the strip, plug into two five-way binding posts mounted atop the Minibox, connecting the thermistors to the measuring circuit.

Thermistors are a special kind of resistor—their resistance drops as temperature increases. By measuring the electrical resistance of a thermistor, we can find its temperature.

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The measuring circuit is a simple Wheatstone bridge. One of the thermistors has a small piece of sponge fitted over it. A few minutes before taking a D.I. reading, the sponge is wetted with water at room temperature. This measures the wet-bulb temperature.

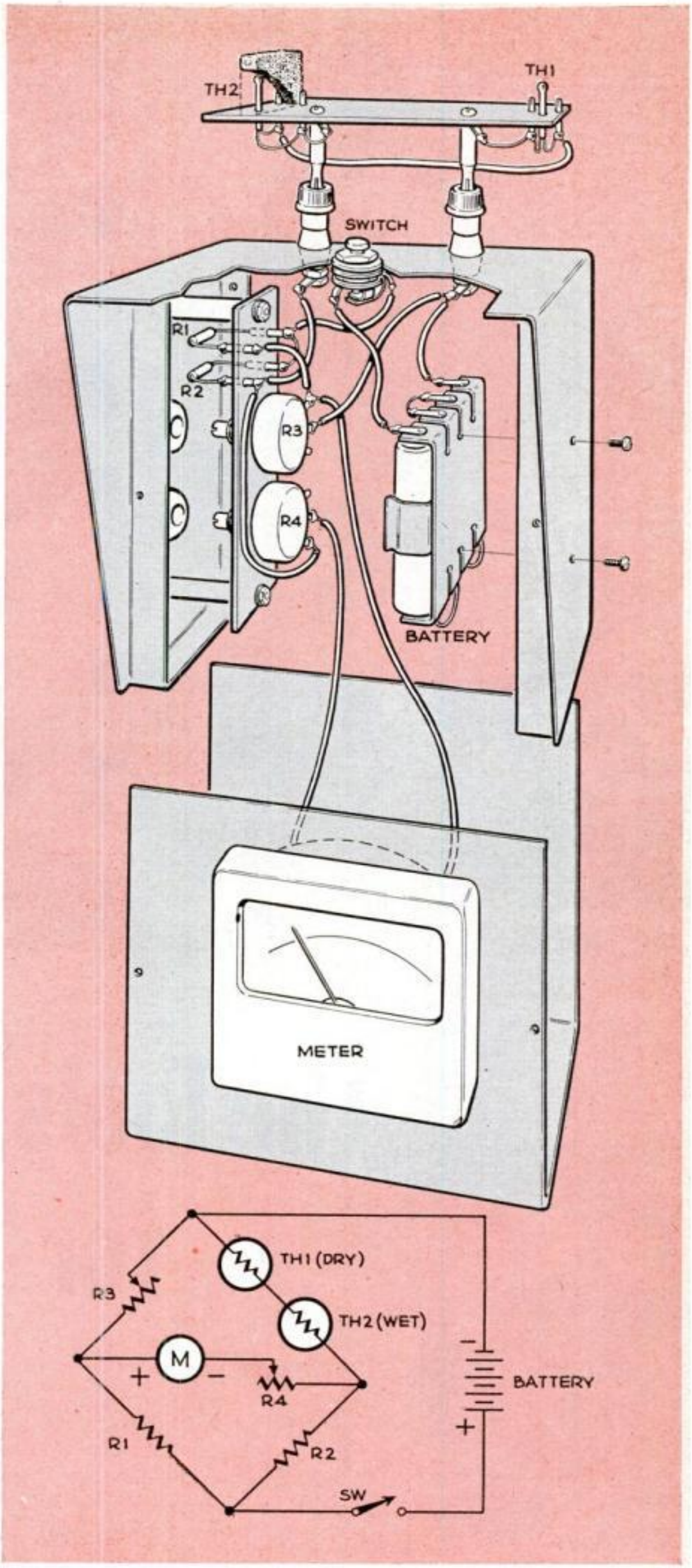
The bridge is designed to measure the D.I. in a range from 50 to 100. Make a new scale for the 0-to-50 microammeter, using stiff white paper and india ink. Number the divisions on the scale from 50 to 100.

Calibration is a two-step procedure. Remove the sponge from the wet-bulb thermistor during calibration. A D.I. of 50 corresponds to both thermistors being at a temperature of about 44 degrees F. Put a few ice cubes in a container of water and stir until the water temperature stabilizes at 44 degrees. Use a photographic thermometer to check the temperature. Dip just the glass bulbs of the thermistors in the water and adjust potentiometer R3 (low-adjust pot) until the meter reads 50.

Your calibration standard at the high end is normal body temperature. After you have adjusted the low-end reading, have a friend grasp the thermistors between his fingers for a few minutes. Adjust R4 (high-adjust pot) for a reading of 95.

PARTS LIST

TH1, TH2—Glass-probe thermistors 2,000 ohms @ 25 degrees C. (Glennite 32PB2)
R1, R2—56,000-ohm, ½-watt carbon resistors, 5% tolerance.
R3—10,000-ohm linear-taper potentiometer
R4—50,000-ohm linear-taper potentiometer
B—4 pencells (size AA) wired in series, mounted in battery holder (Keystone 182)
SW—SPST normally open pushbutton (Switchcraft 101 Littel switch)
Meter—O-50 DC microammeter (Lafayette TM-70 or equal)
Misc.—Cowl-type Minibox (Bud SC-2133), bolt-on banana plugs (Smith #102), 5-way binding posts.



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PS TOOLS



PIPE-HOLDING TOOLS

Two vises are made especially for pipe. Yoke type (above, right) pivots open so long pipe can slip in sideways. Ridge Tool's chain vise (above) works by tightening an adjustable chain around pipe. Most machinist's vises have pipe jaws, as below.



The Tools You Need for Pipe Jobs

By Ralph Treves

CUTTING and threading your own pipe are satisfying jobs that require only a few special tools. While cast-iron water pipe isn't used much today for plumbing, it's ideal for making sturdy tool stands, bench supports, lumber-storage racks, outdoor play equipment, and the like.

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Two of the tools you'll need are already common shop items—a hacksaw and a stillson wrench. Many bench vises include pipe-jaw inserts, so you may also have the third requirement—a means of holding the pipe securely while you work on it.

All that's needed to fill out the set is a thread-cutter for threading the ends of your pipe to take standard fittings. This consists of a thread-cutting die to fit the size of pipe you're using and a stock to hold the die. The stock has long bar handles to give you leverage for turning the die onto the pipe. A simple stock-and-die set for handling the two most common pipe sizes—½" and ¾"—costs $12 to $15.

For convenience, you'll want to add a few more specialized tools as you go on. These should include:

- A portable pipe vise that you can carry to the job.
- A wheel-type pipe cutter with which you can make accurate cuts more quickly and easily than you can with a hacksaw.
- A five-size stock-and-die set for handling all pipe sizes from ¼" to 1".
- A reamer for smoothing off the sharp burrs left on the cut ends of pipe.

Holding the pipe. There are two types of vises for gripping pipe without distorting it. One, called a yoke vise, has rounded jaws with serrated teeth that are clamped against the pipe with a jackscrew. The other type uses a sprocket chain that's cinched up tight around the pipe with a screw.



The chain vise may be a bit faster to set up since you just hook the chain around the pipe, but both are good. Both also come in types designed for portability. One kind can be fastened to any handy object with C clamps. Others have mounting holes for bolting to a board, which in turn can be clamped to something stationary.

Post-type vises are designed for attachment to a lally column, beam, or tree by means of a chain. You can also get tripod vises that stand on their own legs, but these are bigger and more expensive than you'll need for average shopwork.

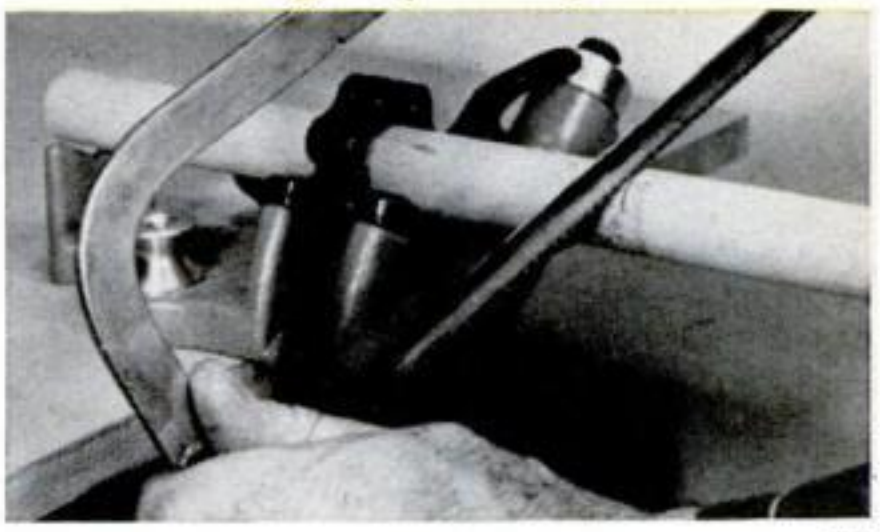
Pipe vises are rated according to the maximum size of pipe they'll take. The smaller models handle pipe up to 1¼"—plenty for most shop needs. Larger types handle sizes up to 2½". Prices start at about $5. The better vises have replaceable tool-

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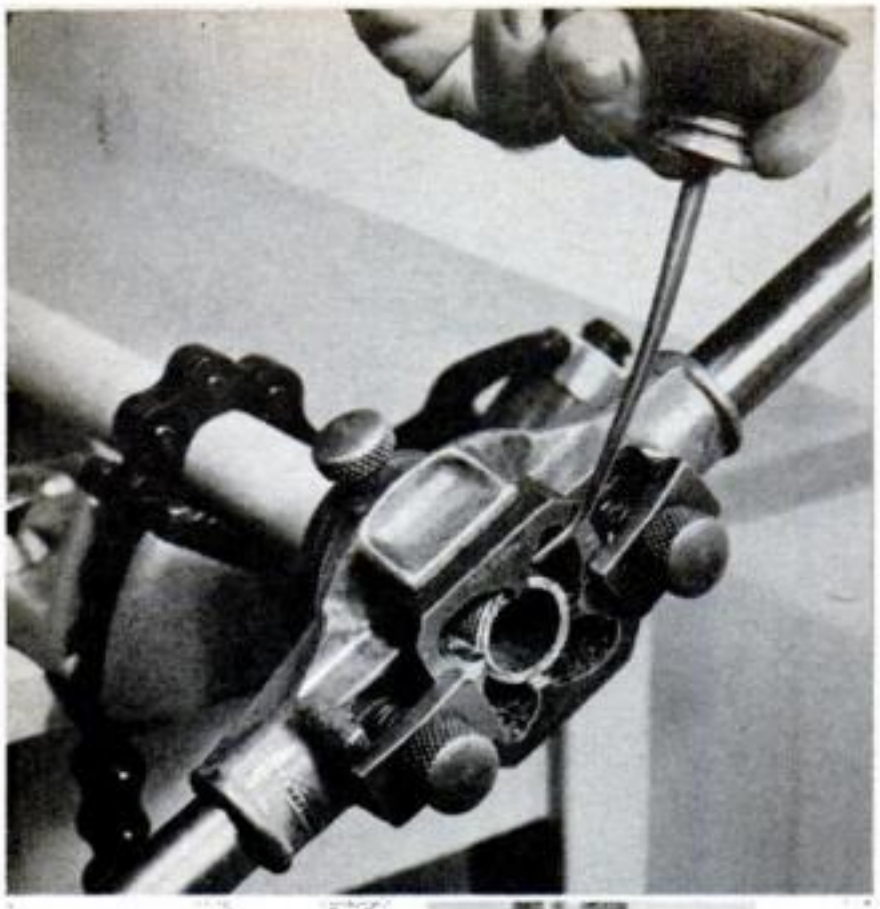


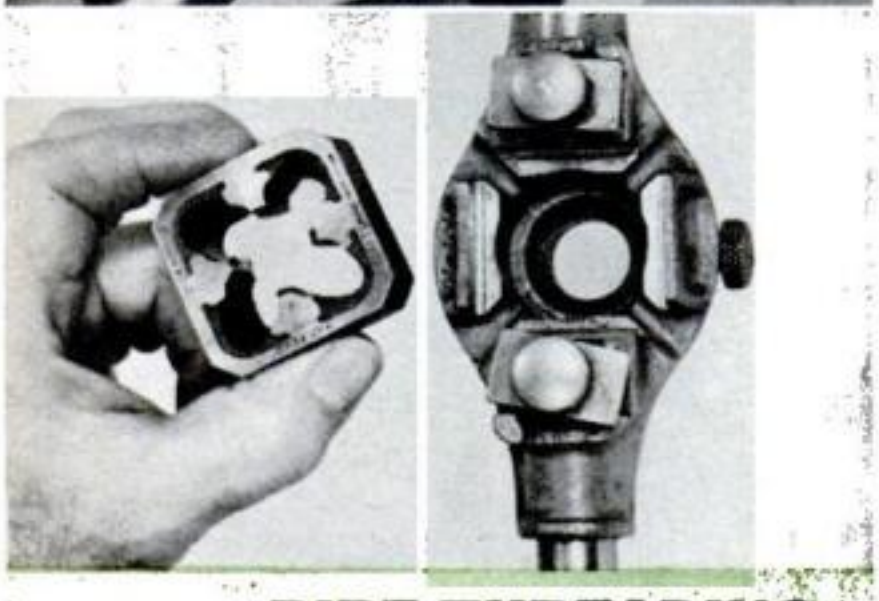
PIPE-CUTTING TOOLS

Wheel-type cutter (top photo) is fast, makes a straight cut automatically. As you rotate it around the pipe, you also twist handle tighter, forcing the wheel deeper and deeper into the metal. If pipe is for plumbing, you smooth inside edge with a reamer (above) to remove the rough burr. To hacksaw pipe (below), make marks around it to guide you straight.



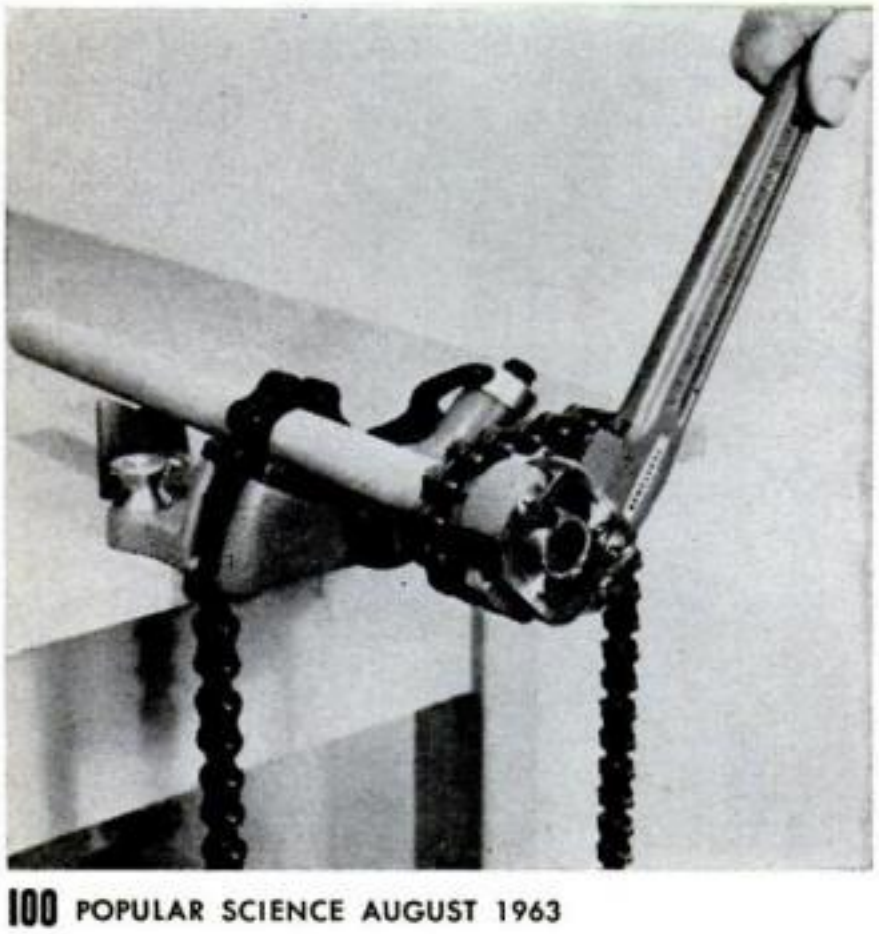
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PIPE-THREADING TOOLS

Standard threader (above) holds various sizes of interchangeable dies. Dies are clamped in the handle with two screws. For occasional work, special Sears, Roebuck dies (below) require no handle, can be turned on with a chain or stillson wrench. They come in ½" and ¾" sizes.



steel jaws that can be renewed if they become worn.

In a pinch, you can even thread a pipe without a vise. The trick here is to block the threader against something solid and turn the pipe into it with a wrench, instead of turning the threader onto the pipe.

A cutter makes it easy. You *can* cut pipe with a hacksaw, but it's hard to get the cut straight—important for starting the threading die properly. A wheel-type cutter is self-aligning and makes the job a breeze.

For home-shop use, the best cutter is the single-wheel, double-roller type of 1" capacity. This sells for about $6. There's also a triple-wheel type that's faster cutting, but this takes a knack to align the wheels.

The only disadvantage of a wheel cutter is that it tends to roll a deep, rough burr on the inner edge of the cut. This is no problem on pipe intended only for structural use, but it could hamper the flow of water in plumbing or fray the insulation on electrical cables.

Here's where a reamer comes in handy. This is a cone-shaped fluted tool that's chucked in an ordinary hand brace. A few turns in the cut end of a pipe will quickly smooth off the rough burrs. You can buy a reamer that will handle pipe up to 1¼" for about $3.

Lacking a reamer, you can also smooth off burrs with a half-round file. One trick of the pros is to start the cut with a wheel-type cutter to insure straightness, then finish up with a hacksaw to give a clean edge.

If you want to use only a hacksaw, here's one way to help get the cut straight. Wrap a piece of soft cardboard around the pipe at the cut point and draw a line along it all around. Make a series of shallow cuts with the hacksaw along the line, turning the pipe as you go. Then saw all the way through, following the cut marks as a guide. Use hacksaw blades with 18 teeth to the inch.

Choosing a threader. There are two types of threading dies—solid and split. The solid type is a one-piece ring that's simply clamped in the stock. The split type consists of two half-rings that must be adjusted for proper spacing between them.

Split dies let you vary thread-cutting depth and are useful in plumbing work, but it takes some care to set them up. Solid dies require no setting up and are the

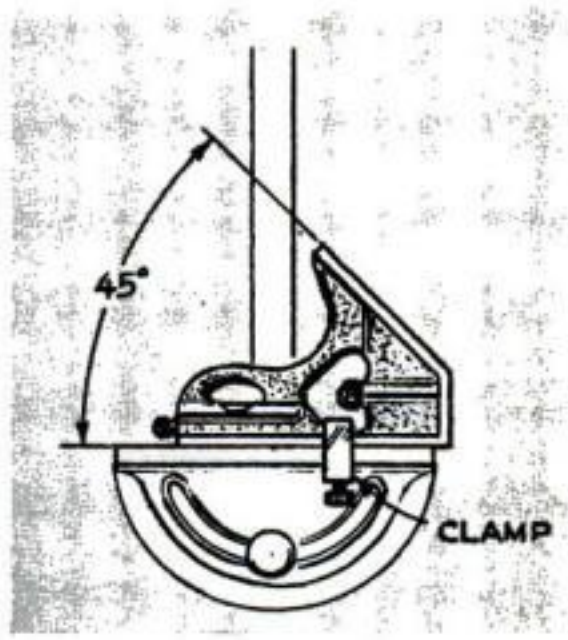
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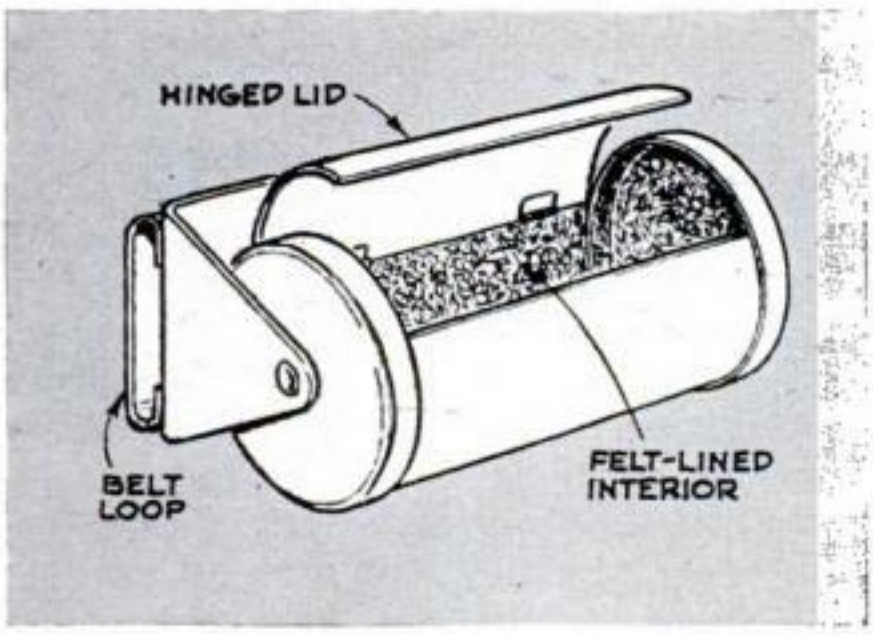
Sanding job is in the bag—to catch dust

As an apartment-dwelling handyman, I have to be careful not to let sawdust scatter around while I'm working on a project. I therefore do small sanding jobs inside a plastic bag from the dry-cleaners. I tie a knot in the top end and place my hands and the work in the bottom end. Sanding back and forth creates a movement of air that keeps the light plastic up out of the way. The sawdust is confined in the bag, and I throw it and the bag away when the sanding job is finished.—*William Sill, NYC.*



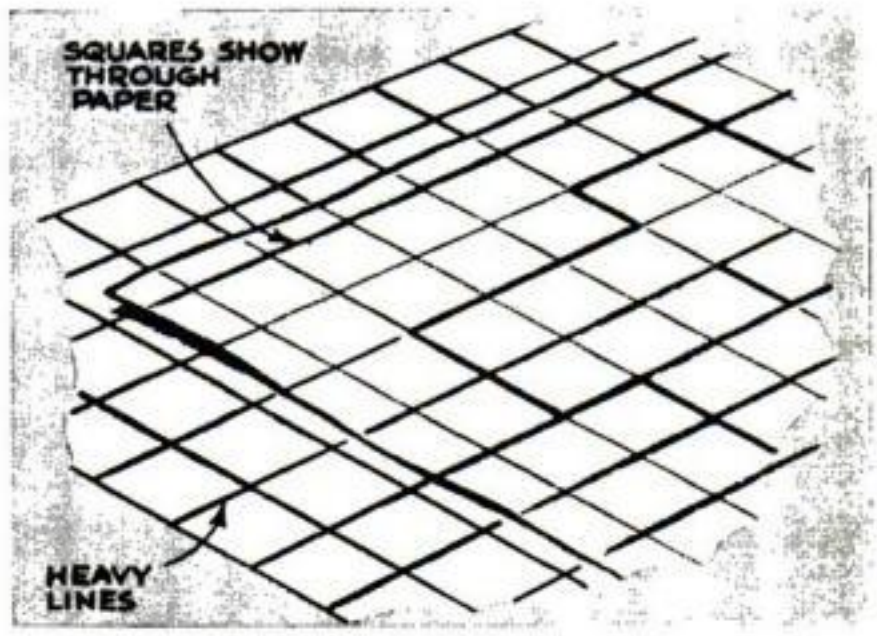
Combination square for perfect miter joints

I've got a way to make perfect miter joints every time. Instead of changing the cross slide on my table saw from 90 degrees to 45, I clamp the 45-degree frame of a combination square to the cross slide. After I make my cut, I flip the molding and cut the other end. The angle never varies.—*A. Sandgren, Sound Beach, N.Y.*



He carries his ammo in a bait box

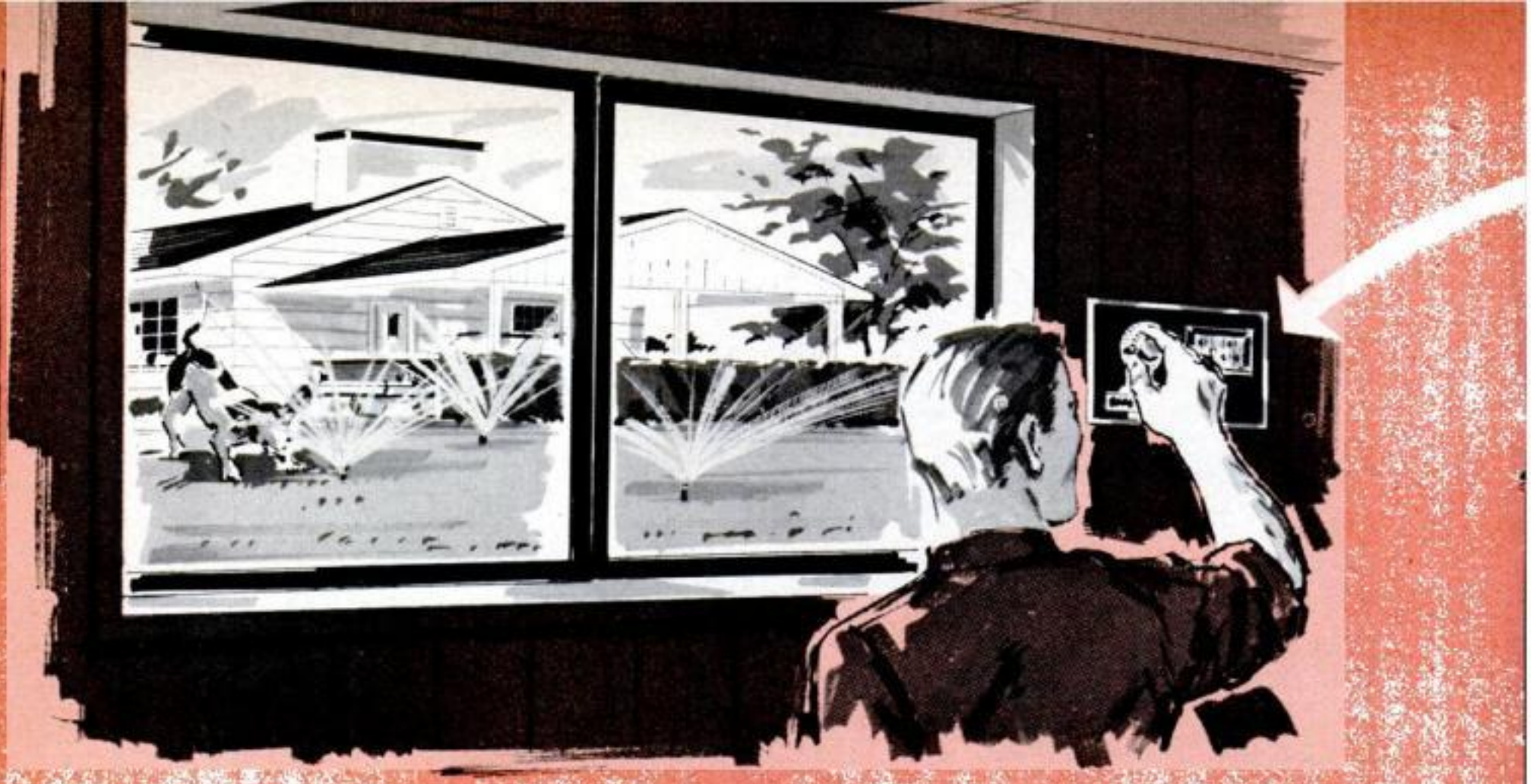
Here's a handy idea for a gunner at target practice. A bait box that mounts on the belt makes a handy ammunition carrier. Line it with felt to make it soundproof and keep the bullets from scuffing. The built-in revolving feature keeps the cover closed when the box isn't used.—*Edwin B. Johnson, Iron River, Mich.*



Easy way to enlarge drawings

If you enlarge drawings by squares, here's a procedure that makes it unnecessary to erase squares from the finished drawing. First draw squares with black ink on a large sheet of paper. Then tack transparent paper over it, and make the drawing on this. You can use the squared sheet over and over again.—*Frank Shore, NYC.*

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New Robot Rainmakers for Wall-to-Wall Lawns

These electric brains never forget: They'll water your lawn on a preset schedule—or skip the job if it rains

By Harry Walton

"FORGET the faucet!" is the cry of one maker of automatic-sprinkling systems. And you can, with a robot water boy on the job. You'll never have to turn a valve. He'll do the entire chore, day after day and week after week, never forget or skimp, and save the water an amateur greens keeper is likely to waste.

Although fully automatic systems cost upper-bracket prices, they're sure to become cheaper as more makers enter the booming market. Here's what a deluxe sprinkling system can do for you:

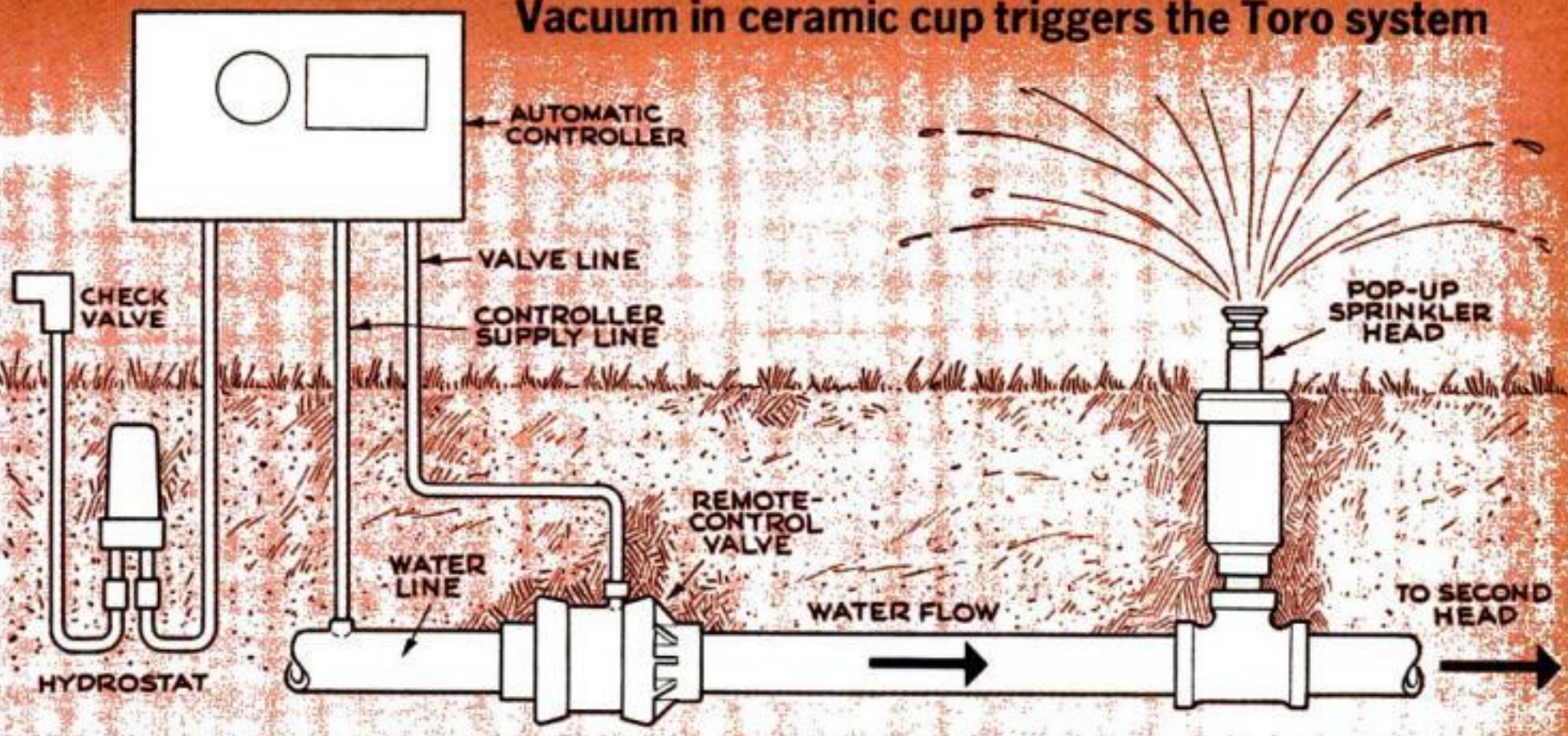
- Watch soil moisture at the roots.
- Signal before it's dry there.
- Turn on water in dry areas only.
- Deliver only as much water as the soil can absorb.
- Shut off and yank sprinkler heads down, out of the way of mowers.
- Work nights when water pressure is most stable, kids aren't rolling on the lawn, and there is no sun to hasten evaporation.
- Remember to water even while you're away on vacation.

You set the timer once for the whole season, to water at the time and on the days you choose—say from midnight to six, except Thursdays and Sundays. The robot brain takes it from there. If rain makes watering unnecessary, the fancier rigs stay shut off.

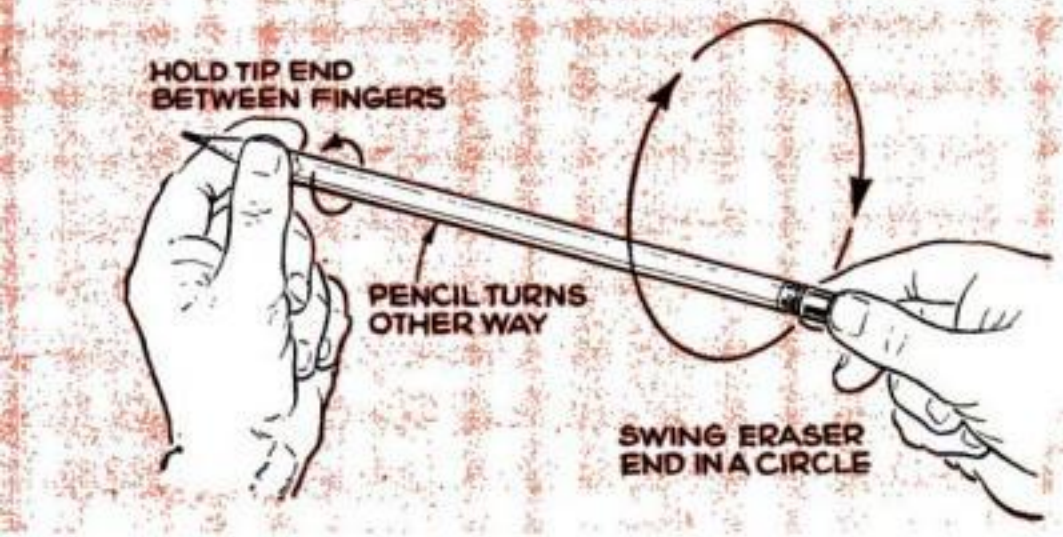
Designs in water. Some sprinkler heads can water circles, part circles, or rectangles —anywhere but around corners (you can buy a walking unit to do that). Rotating heads are driven by tiny turbines. Moisture sensers lurking underground shoot the word

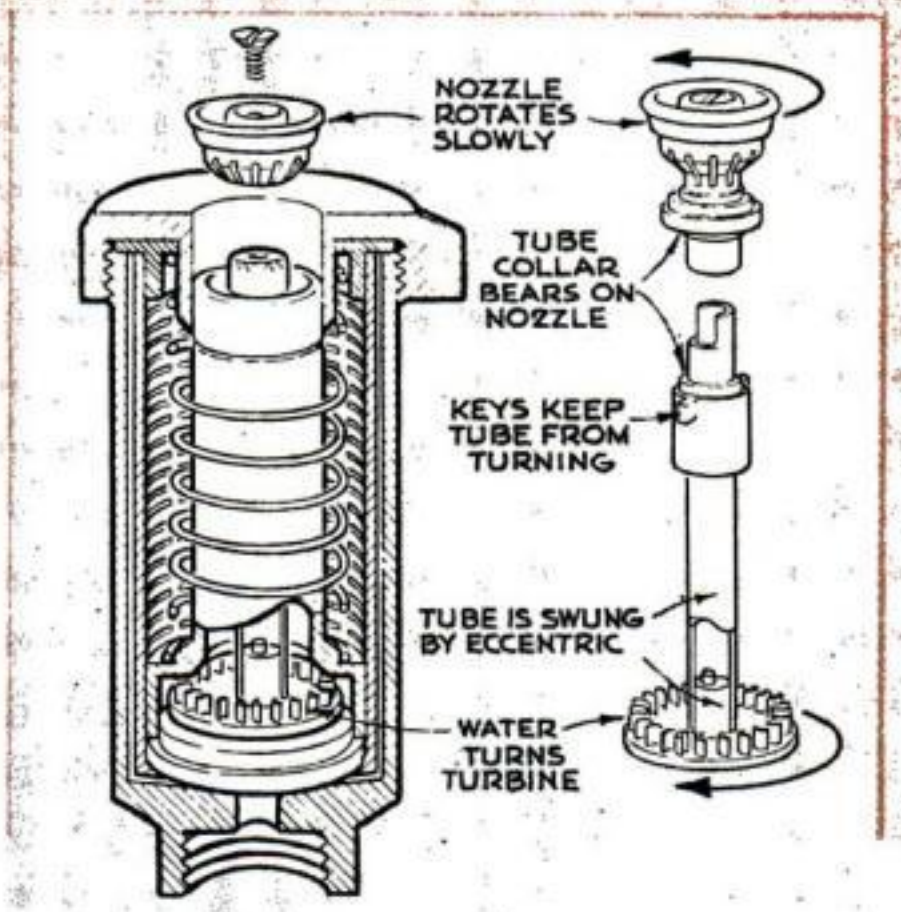
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Vacuum in ceramic cup triggers the Toro system



When hydrostat vacuum actuates a diaphragm in the controller, solenoid valves apply water pressure to remote valves, turning on sprinklers. In Toro Moist O'Matic pop-up heads (at right) a turbine swings one end of a tube but doesn't turn it. Friction at upper end rotates nozzle. Try pencil stunt below to see how.





to electronic circuits that trigger valves by electricity, hydraulic pressure, or both.

Plastic is a boon. Polyethylene pipe used for lawn plumbing is easy to install and unharmed by freezing. Sprinklers and valves made of plastic don't rust or corrode. Parts molded at one shot complete with threads, slits, and screens cost less than machined ones. Self-lubricating plastic outlasts metal by as much as four to one.

Zone hopping. Systems are zoned to water one area and then shift to the next. Often necessary because water pressure isn't up to doing the whole job at once, this also permits use of smaller (and cheaper) valves and piping.

Minneapolis-Honeywell, famous for controls, has a system in which the electric timer opens and closes one zone valve after another at 15-minute intervals. All the automatic valves can be installed in the cellar, doing away with outdoor wiring and making them easier to service. Watering time for individual zones can be set at 5 to 30 minutes. A ceramic moisture senser is in the works at Honeywell's research labs.

The testing thumb. Because a thriving lawn depends on an ideal amount of moisture at all times, the Muellermist Moisture Master uses two sensers in each zone. One is buried near the surface, the other some inches deeper. Connected in series, these conduct more electricity as moisture increases, less as the soil dries. The detector circuit includes a setting you can adjust for the differing moisture needs of various grasses.

If zone sensers report moisture under par, sprinkling begins. When moisture reaches the preset optimum, enough cur-

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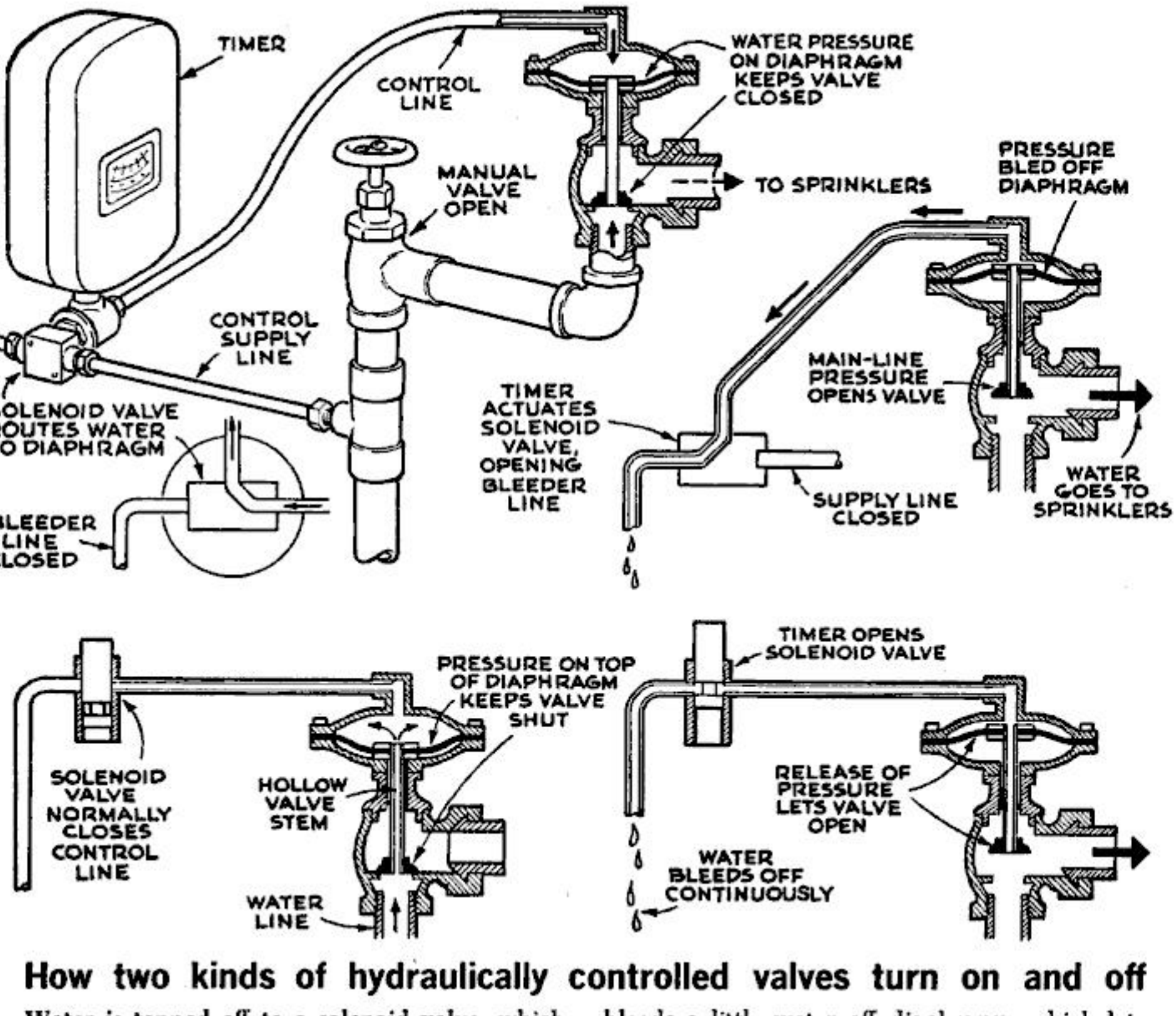
rent flows in the detector circuit to induce a starting voltage in a cold-cathode tube. Its plate current then moves a stepping relay to the next zone.

Should the sensers there report no need for water, the signal makes the tube trip the relay to the next zone. If any is drier than the setting prescribes, sprinkling goes on until that zone's sensers are satisfied. If no zone needs water, the system sulks for 24 hours, then tries again.

Muellermist's paired sensers aren't deceived by sun-dried topsoil—surface watering goes on only until the top senser reports enough. But a light rain that only wets the surface won't satisfy the lower senser, which yells for water. This conscientious behavior, the makers say, can save up to 40 percent of the water used by detectorless systems. Muellermist makes those also.

Valves that remember. In the Sequa-Matic system, valves cut in the zones. There's a master valve in the main line and, where each zone line branches off, a unique sequencing valve. Operated by water alone, these valves require no control tubing or wiring.

The Seele Rainbrain, made by Pacific Tool and Die Co., of Los Angeles, also has buried detectors and a dial you set for moisture desired. But to avoid surface

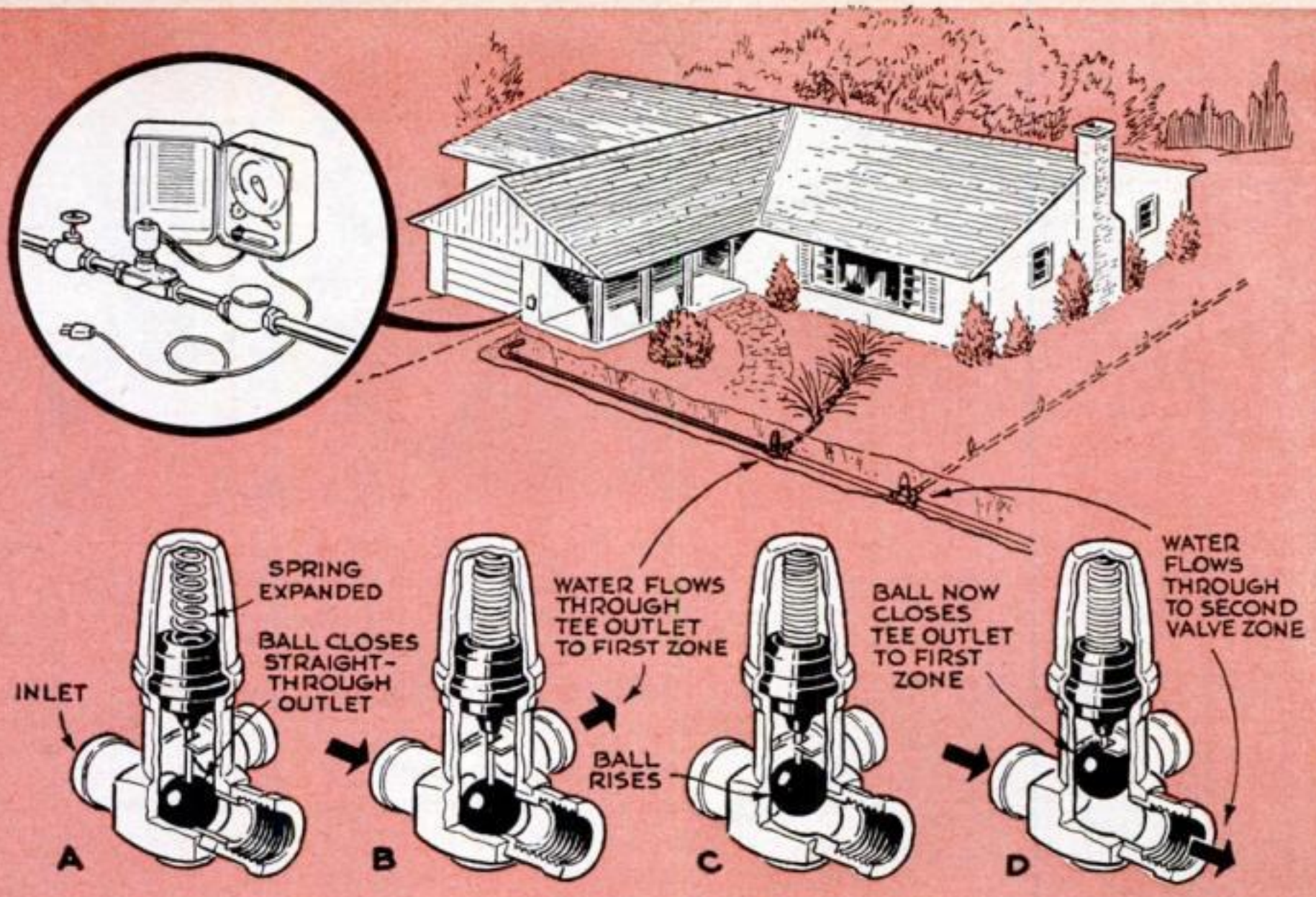


How two kinds of hydraulically controlled valves turn on and off

Water is tapped off to a solenoid valve, which timer trips to operate zone valves, in the Greenland system. In type A, solenoid valve maintains pressure on a diaphragm in the zone valve, keeping it closed. When timer calls for sprinkling, solenoid valve cuts off the pressure and bleeds a little water off diaphragm, which lets valve open. In type B (lower priced for installations where valves are less than 40′ from controller), the solenoid valve is normally shut. Tripped, the valve bleeds off a trickle of water as long as the sprinklers are running.

Greenland Automatic Sprinkler Control: by Superior Controls Co., Inc., Los Angeles.

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Flow-controlled sequence valves shut off one zone, turn on the next

The Sequa-Matic timer controls only a master valve directly. Starting and stopping of the water operates sequence valves as above to sprinkle one zone after another. Watering over, all sequence valves return to first position. Controller can be set to water each zone for a different length of time. John Bean Division of Food Machinery & Chemical Corp. makes it.

overwatering (causing run-off and leaching nourishing elements out of the soil) the timer waters a zone only for 10 minutes at a time—or less, if that satisfies the senser. The system then sprinkles the next zone. After one hour, time enough for the soil to absorb the water, the detector circuit rechecks all the zones. If any call for more moisture, sprinkling again goes on for a maximum of 10 minutes.

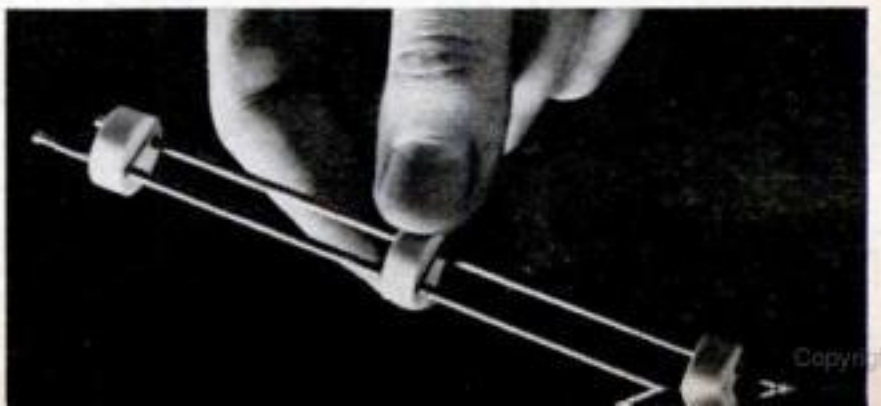
The Moist O'Matic system offered by

[*Continued on page 156*]



Control settings of the Moody Rainmaster system can time sprinkling period of each zone up to 15 minutes, with immediate repeat if desired. Small dial at top left determines what days of the week sprinkling is to be done. Remote-control valves (bottom of photo) are adjustable to prevent water hammer in the lines.

Two-rod electrodes in ceramic mounts measure dampness in the Moisture Master system (Muellermist Irrigation Co., Maywood, Ill.). Two such detectors, buried at different depths, gauge both surface and root moisture.



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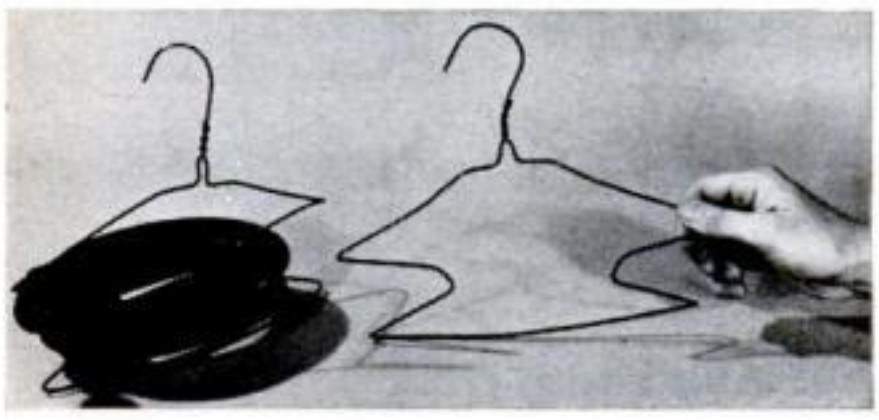
Short Cuts and Tips FROM PS READERS



Removing deposits from a circular-saw blade

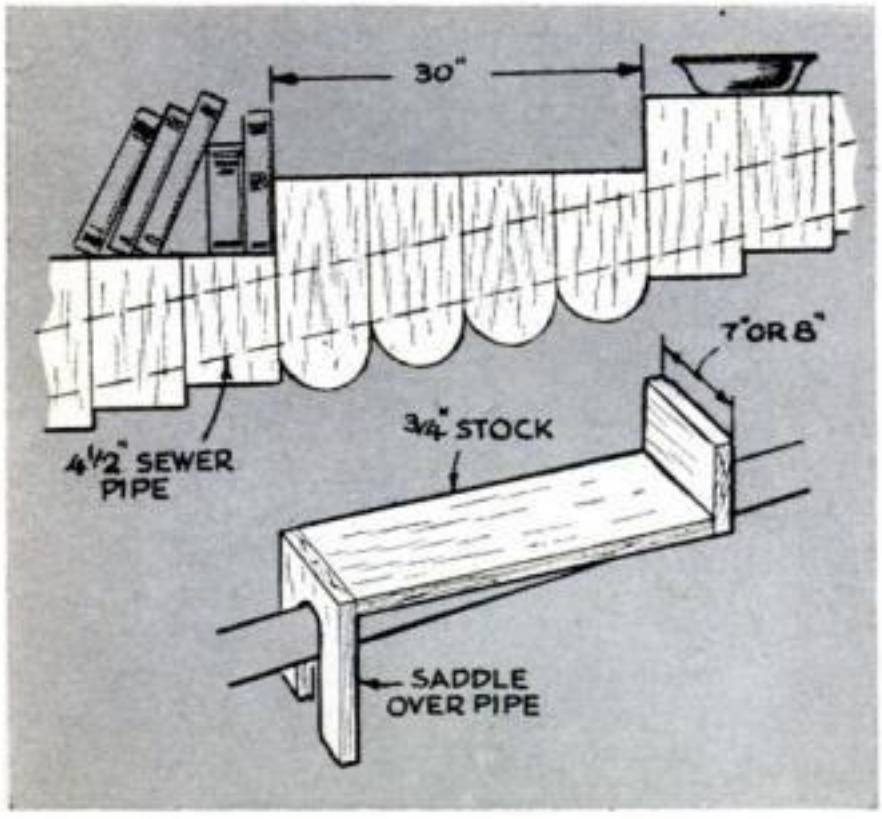
When a scorched, gummy deposit on my circular-saw blade refused to yield to ordinary solvents, I tried an oven-cleaning preparation. In minutes the deposit was loosened enough to be rubbed off with the applicator brush.

I rinsed the blade in water and vinegar to neutralize any alkali left, rinsed again, dried and polished it with a light machine oil. (Incidentally, always remove a blade to be cleaned from the saw mandrel.)—*Walter E. Burton, Akron, Ohio.*



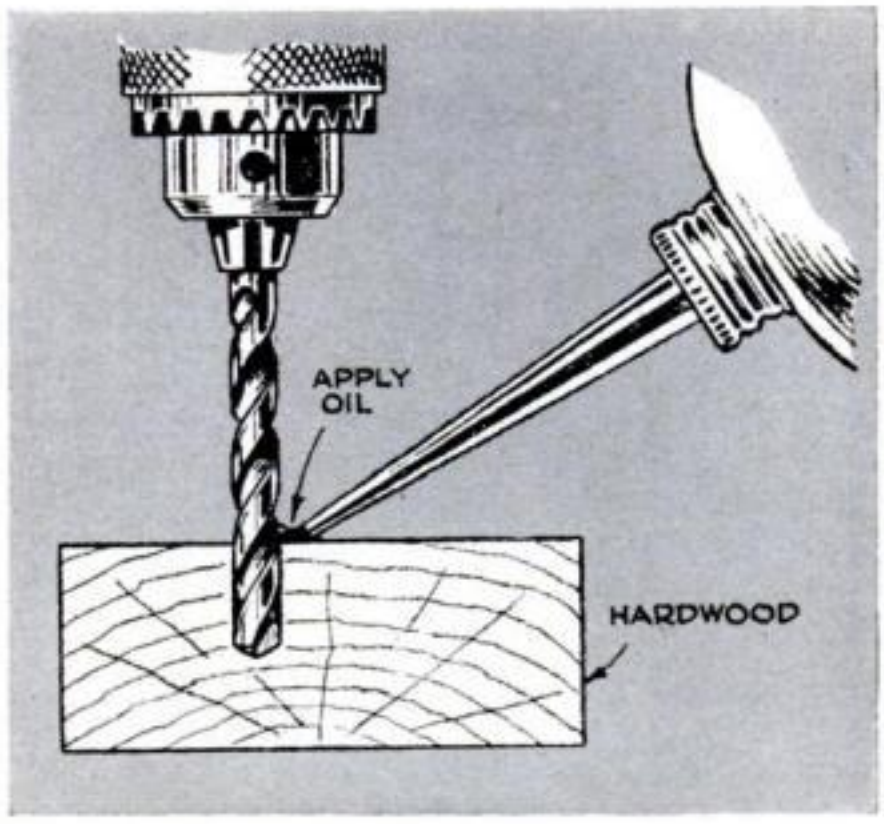
Bent coat hanger keeps cord neat

Want to put an end to searching for that extra extension cord? A wire coat hanger solves the problem easily. Bend the points inward (photo at left), and wrap the cord around it. Now, when needed, you can put your hand on a neatly stored cord.—*Ken Patterson, Regina, Sask.*



Step shelves hide sewer pipes

Here's an easy way to hide those sewer pipes that ruin the appearance of your basement playroom: Use a combination of cover and shelves. Measurements shown may be changed to suit pitch and run of the pipe. The solid boards should be put on first, with the paneling nailed to them. Match the shelves to the rest of the room by using a straight, curved, or rustic edge. —*G. W. Hummer, Frenchtown, N. J.*



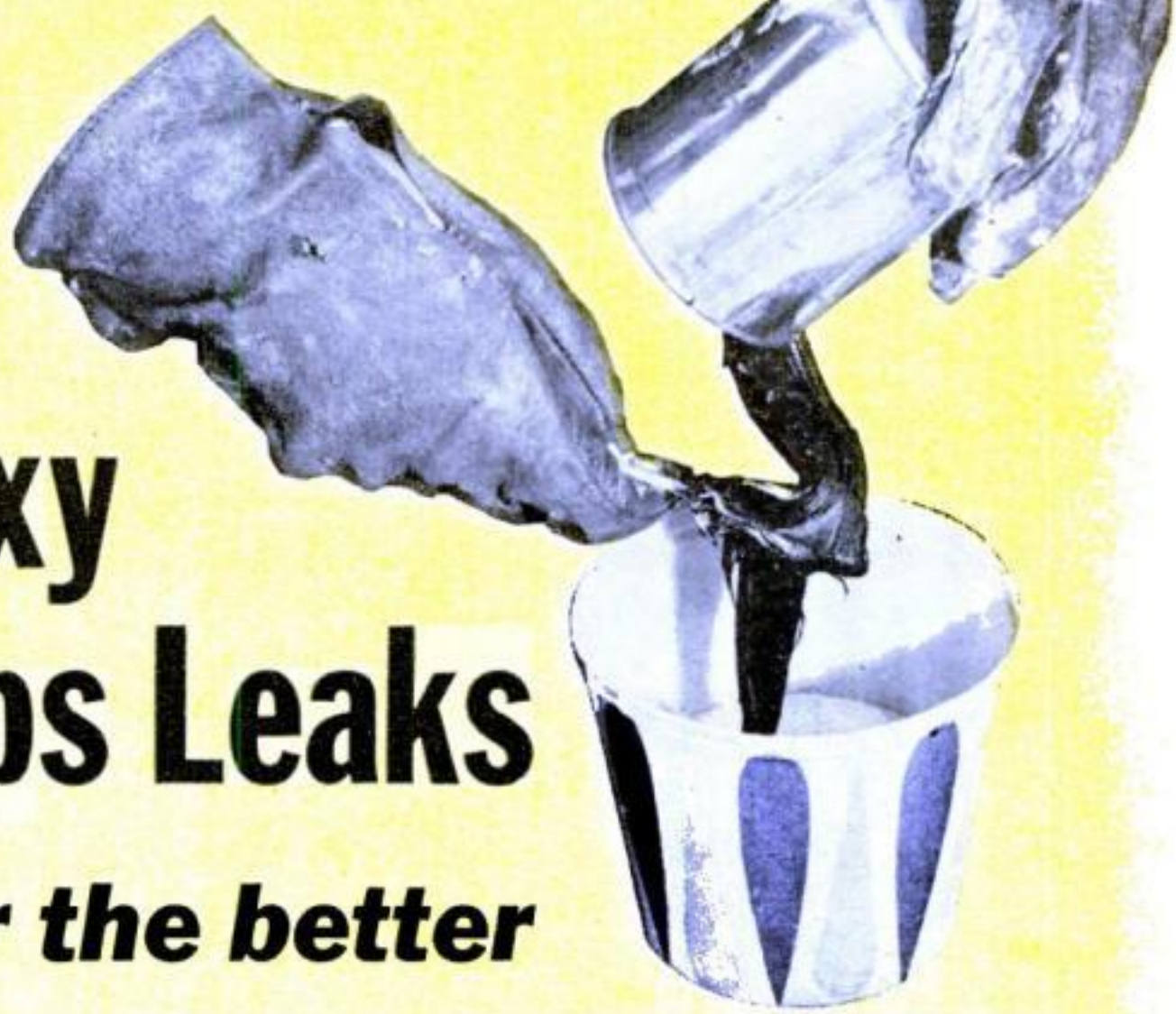
Drilling cleans twist drill

For a simple and harmless way to clean a rusty twist drill, try this: Drill it into a block of hardwood while applying oil from a squirt can (above). Be sure to run the drill in several times at different places until it's thoroughly clean. The cleaning or scouring action is accomplished by the friction of the drill against the wood and wood chips. The oil loosens rust as it lubricates. —*H. J. Gerber, Menomonie, Wis.*

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In-the-water repairs to a boat hull are no magician's trick with this new epoxy patcher. It actually sticks—and dries—underwater. It comes in two parts that you mix before using, creates a sticky goo that bonds to anything wet.



New Epoxy Stops Leaks

—*the wetter the better*

By James Joseph

PICTURE yourself far from shore when your boat springs a dangerous leak. You calmly mix up a batch of taffy-like goo, smear a handful over the hole, and magically the water stops pouring in. What's more, the patch eventually hardens into a permanent repair, stronger than the hull itself.

Farfetched? Not with a new water-cured epoxy resin that actually *dries* underwater. The thick, sticky goo bonds itself to anything that's wet—wood, steel, or concrete—and the wetter it is, the better it sticks. Patching a boat hull without taking the boat out of the water is only one of its many dramatic uses. You can plug a basement leak, mend a broken water pipe, or patch a hole in the roof—all while the water is still pouring in and you can see easily just where the leaks are.

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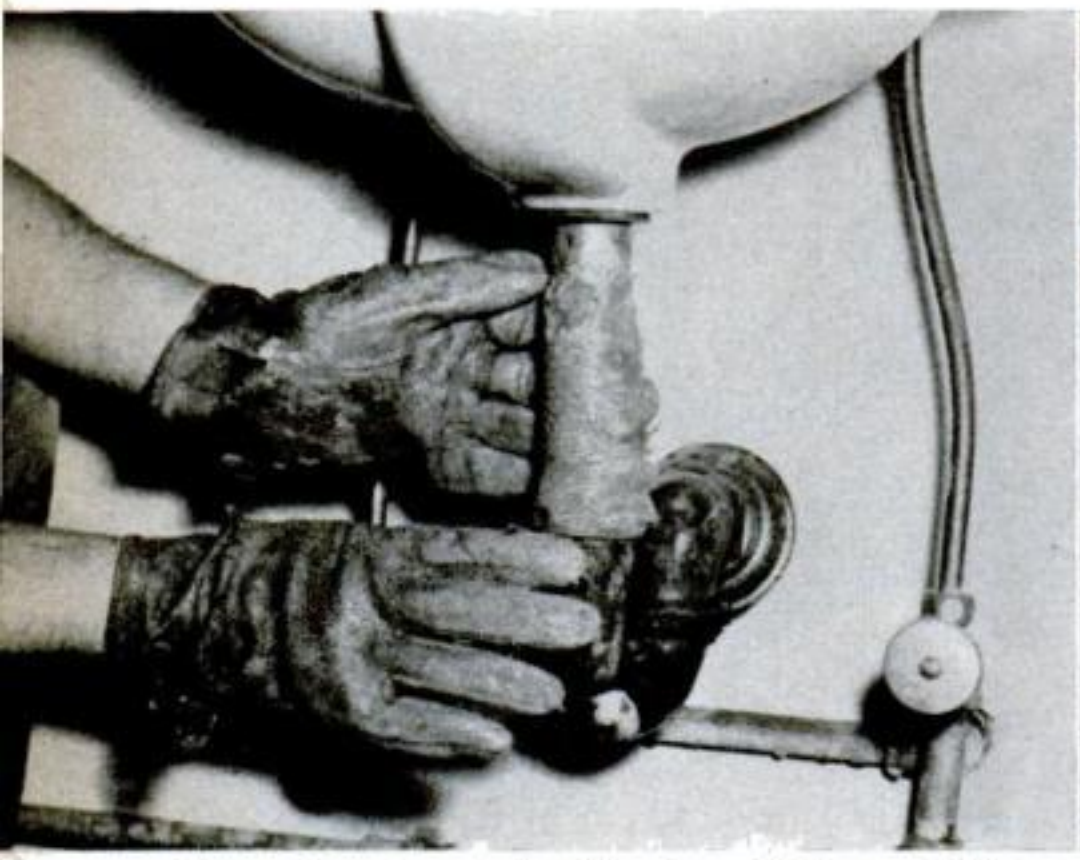
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There's no need to wait for a leak to stop before you can patch it. Breaks in a basement wall—or anywhere else—can be sealed with a gob of "wonderful goo" while the water is rushing in.



If an underground pipe breaks, you don't have to dig it up and replace it, or even drain the line. Just uncover the leak, smear on some of the epoxy sealer, and cover it over again.



Large breaks can be "bandaged" by combining the epoxy goo with fiberglass cloth. Smear the cloth on both sides with the goo and wrap it around the break to make a strong patch.



Quick cure for a rusted-out gutter: Coat the corroded areas with goo and you have a gutter that's as good as new. Use fiberglass technique, as at left, if metal is badly eaten away.

To "dry" underwater, the epoxy sealer generates its own internal heat. This chemical heat—as high as 180 degrees—cures the epoxy regardless of the amount of water present, although hardening time does vary with the temperature of the water. In near-boiling water, as in a hot-water tank, a repair patch may quick-harden in 10 to 20 minutes. At a chill 50 degrees, it may take several days to cure completely, while providing a water-stopping seal meantime.

What you get. The result is a water-impervious coating, ⅛" to ¼" thick, that forms a barrier against corrosion and is often more wear-resistant than the surface to which it's applied. Moreover, it won't support marine growths. The gooey resin bonds molecularly with the wetted surface and sticks like superglue.

Dubbed "wonderful goo," the revolutionary protective coating was developed "by mistake" at Shell Chemical's Houston, Tex., Exploration and Production Research lab. Commercially, it's used to waterproof piers, pilings, water-prone foundations, and other surfaces exposed to wave-splash, rain, or flooding. For home use, it comes in a variety of colors.

If a pipe bursts, you needn't shut off the water or drain the line to repair it. Smear a handful of goo over the leak, working it into the rupture. The sticky epoxy stays put even against considerable hydrostatic pressure. By contrast, most other emergency

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repair compounds are quickly dislodged by water pressure.

Sounds like magic? Shell's underwater paint is that—and more. It's the first practical wet-surface coating that's as applicable to sea-corroded bridge footings as to damp basements.

Shell's been using the goo to corrosion-proof the underwater steel pilings of its offshore drilling platforms. Navy experts, concerned about corrosion of Polaris-missile launch tubes, have also used it to give the tubes a protective coating.

What started it all. A telephone call—rather than lab-bench wizardry—led to the goo's discovery. The call interrupted Shell's senior mechanical engineer, R. M. Jorda, as he was mixing a batch of epoxy.

When Jorda returned from the phone, he found the newly batched resin already hardening and discarded it in a pail of water. It wasn't until several days later that Jorda again noticed the pail—and the chemical miracle that had taken place: The epoxy had not only hardened in the water, but it had bonded itself to the bottom of the pail.

"Right there lies the difference—the goo's ability to bond molecularly—actually to become part of a wetted surface," says Shell. While a few other epoxies harden in water, they neither bond nor adhere to wet surfaces. Shell's basic formulation, which it calls *Epon,* does. More than two dozen paint and plastic makers are putting Shell's formula into production, often tailoring it (with additives) for specialized chores.

Regardless of formulation, the goo comes as a two-part mix: equal amounts of amine-terminated polyamide resin and its catalyst. When the two are mixed, the heat-generating reaction begins almost immediately. The mix must be applied before it hardens—usually within 20 minutes to an hour.

Another oddity: Only when the basic epoxy resin and its catalyst are mixed do you end up with the color you want. If you buy the gray type, for example, the basic resin may be black and its catalyst white. Mix them and you have gray.

Formulations and prices vary widely. And so do claims. One maker, Los Angeles' Andrew Brown Company, calls its goo "Splash-Zone Compound" and tailors it mainly for industrial structures. It's price is about $14.25 a gallon. Applied as a ¼"-thick coating, a gallon covers about 16 sq. ft. So viscous is the goo that a gallon weighs about 15 pounds.

You can even paint a picture underwater



Using scuba gear and a palette of different-colored epoxy sealers, this underwater artist paints a pretty mermaid at the bottom of Florida's Weeki Wachi Springs—proof of epoxy's stickiness.

Another formulator, Permalite Plastics Corp., Costa Mesa, Calif., dubs its specialized marine compound "Sea Go-In Poxy Putty" and claims an antifouling additive makes it even more resistant to marine growths than Shell's basic formula. A pint-sized kit costs about $4.85, a half-gallon kit $16.80.

Others among the many formulators are: Pittsburgh Plate Glass Co., The Glidden Co., Napko Corp., Cook Paint & Varnish Co., Copolymer Corp., Interchemical Corp., and Western Wood Preserving Co.

How it works. Even Shell finds it hard to explain the peculiar reverse-osmosis effect: The epoxy literally sops up moisture from the surface to which it's applied and passes it out through the coating, wringing the underlying surface dry.

Less difficult to explain is the epoxy's downright hostility to marine growths. The slick, nonporous coating simply doesn't give marine life a foothold to cling to. Nor can

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Build This

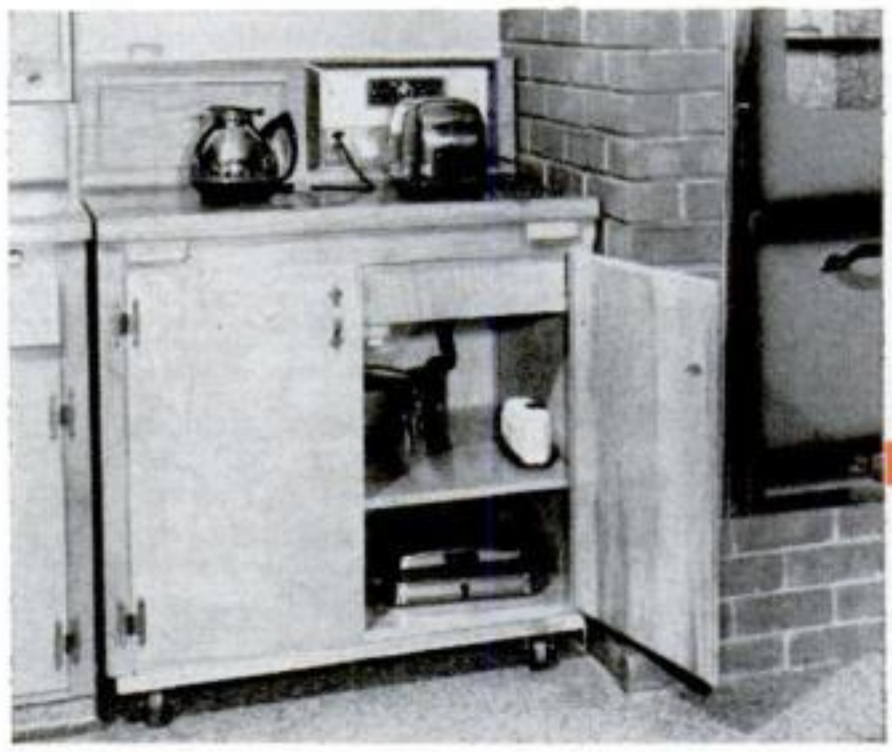
Cook-Out Counter for Your Patio

By Hi Sibley

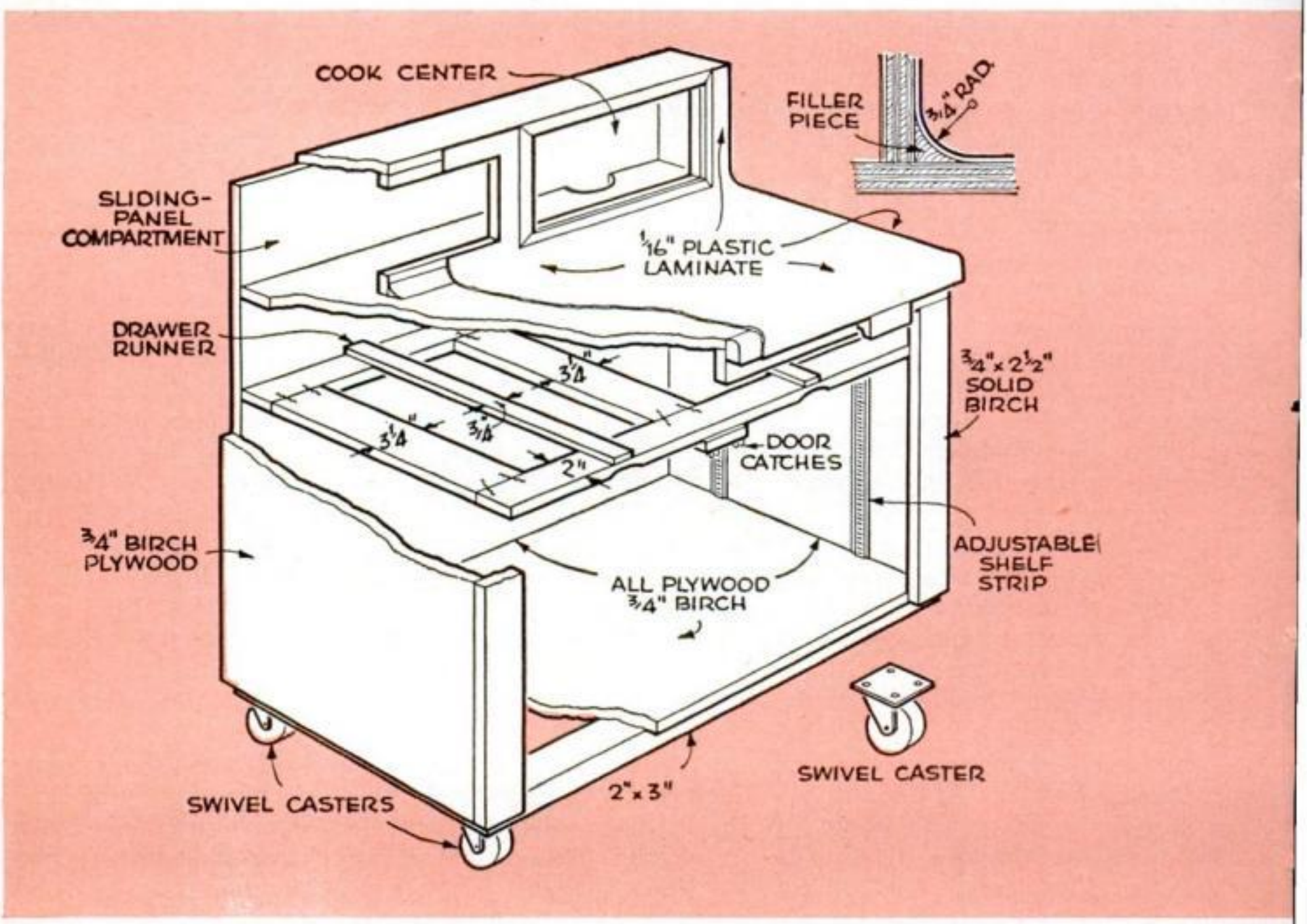
WHO wants to cook in the kitchen on a hot day? Why not roll your kitchen out on the patio and let the breezes eat up those heat waves from the electric broiler? You can do it with this roll-away cabinet plus the many plug-in cookery gadgets on the market. All you need is an outdoor outlet. Plug in the automatic cooking center, inset in the upper panel, and you can time your cooking automatically.

I made most of the cabinet from two 4′-by-8′ sheets of ¾″ birch plywood. The counter top, edges, backsplash, and sliding panels are covered with $\frac{1}{16}$″ wood-grained plastic laminate. The doors were easy—I

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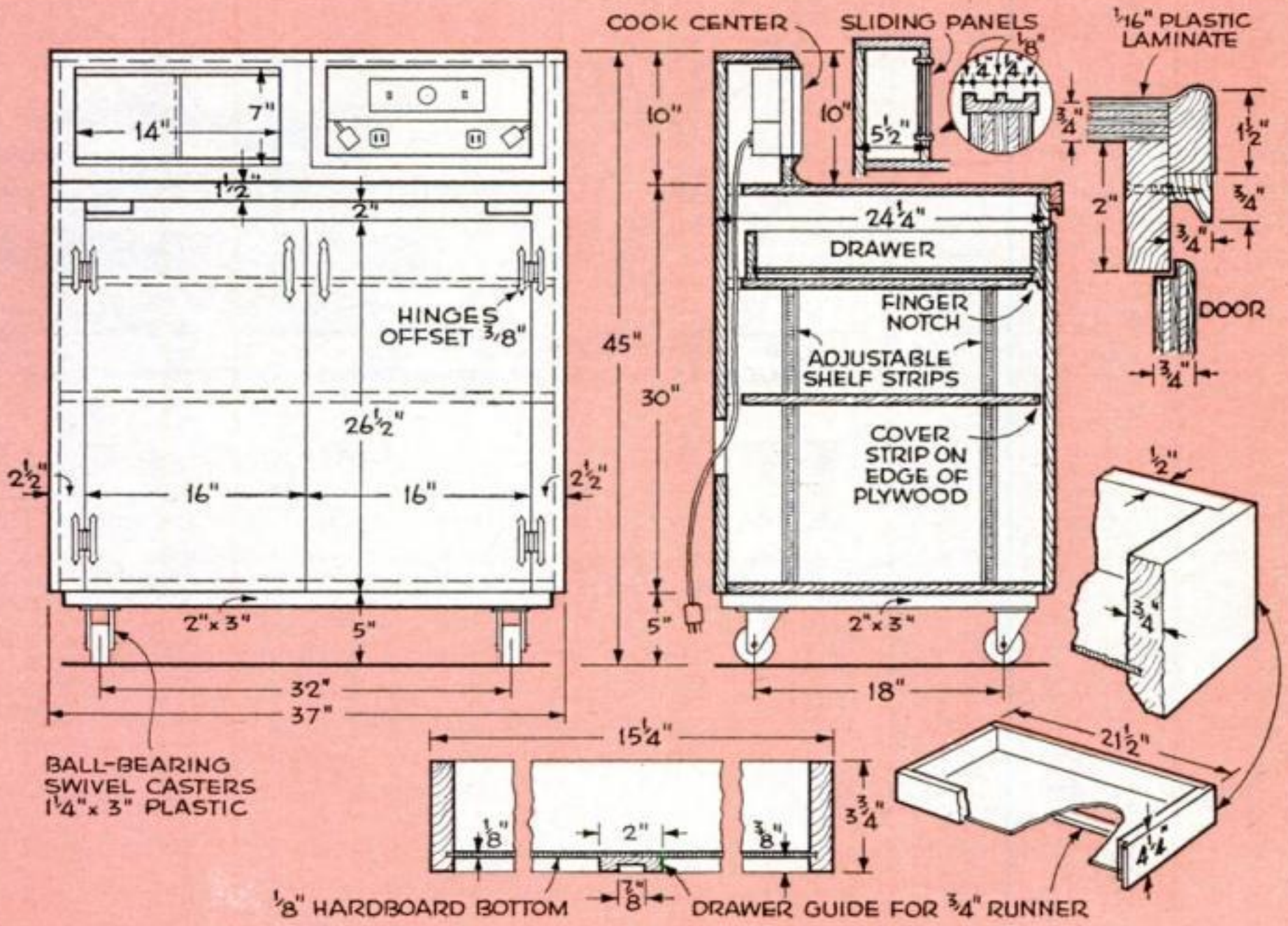


Roll-away cabinet has a regular niche in kitchen—at same 30″ height as built-in units. For patio meals, it glides out on plastic casters.



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simply bought two 16″-by-26½″ birch kitchen-cabinet doors, and attached them to the frame with decorative hinges.

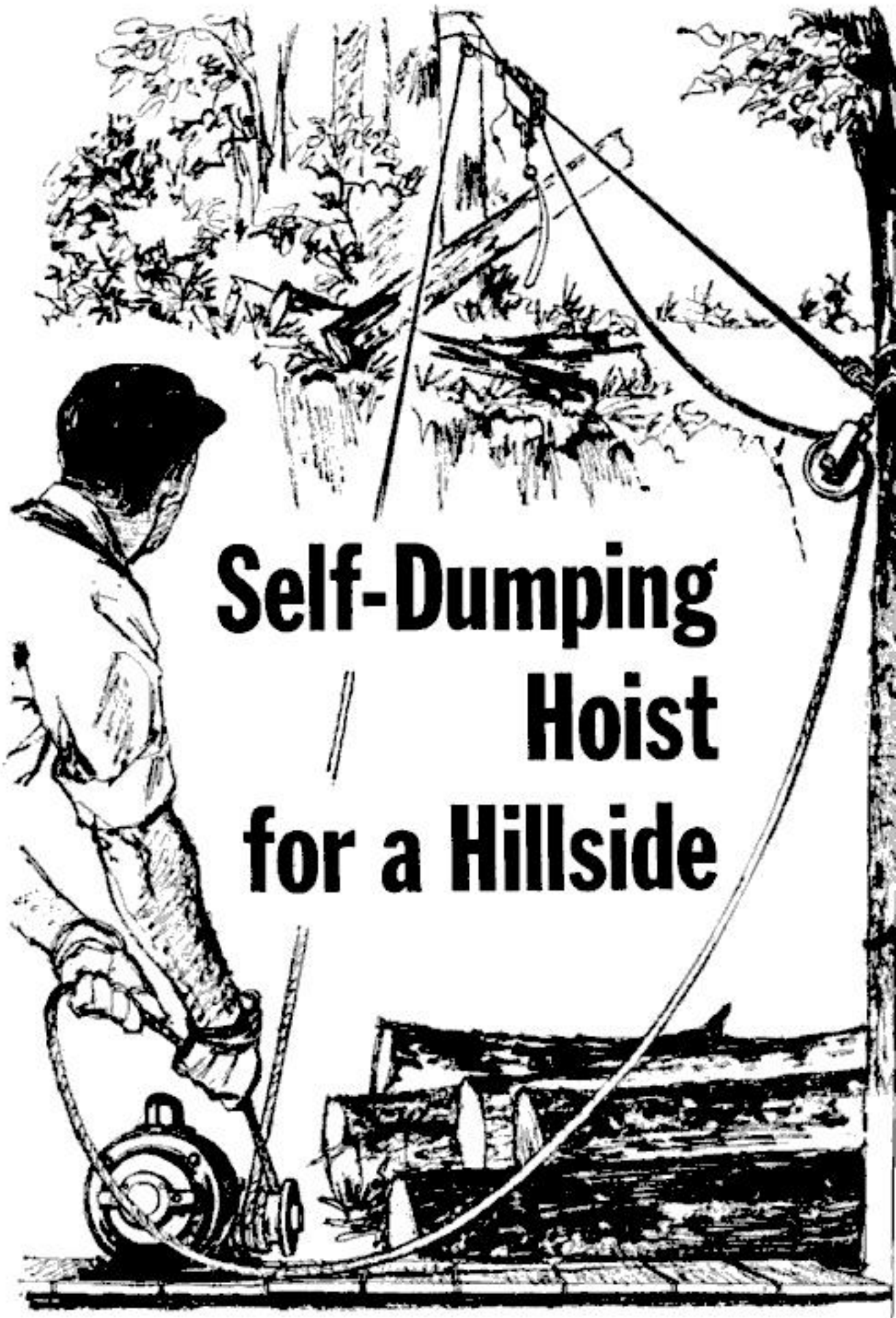
I used furniture glue and four-penny finishing nails to attach the big plywood panels. Wherever I nailed from the outside, I set the nailheads and packed them with wood filler.

Getting the project under way meant making the 2″-by-3″ frame at the bottom. Next step was to cut and nail the plywood bottom to the frame. I cut the side panels, and installed the metal shelf strips on their inner side. Following this, I cut the back, and glue-nailed the sides and back in place.

Before fitting the top, I cut the drawer rails from white pine and assembled them with corrugated fasteners. A rabbeted piece under each drawer rides on a guide rail. Fronts of the drawers are plywood, the bottoms tempered hardboard, and the sides and end pine.

Next came the solid birch members that frame the front, along with the two ¾″-deep birch pulls, screwed fast from the inside. Now I was ready for the plywood top. When it was in place, I framed out the sliding-panel upper cabinet and cook-center housing. Then I cut, beveled, and glue-nailed the molding for the rolled edge in front. It prevents drips from spilling down the front.

My last major cut was for the plywood shelf. Then I was ready to cut and cement the plastic laminate, and add such things as the door catch, the sliding-panel assemblies, and the four caster wheels. When the cabinet was completed, I used a clear finish on the wood to bring out its natural grain. ■■



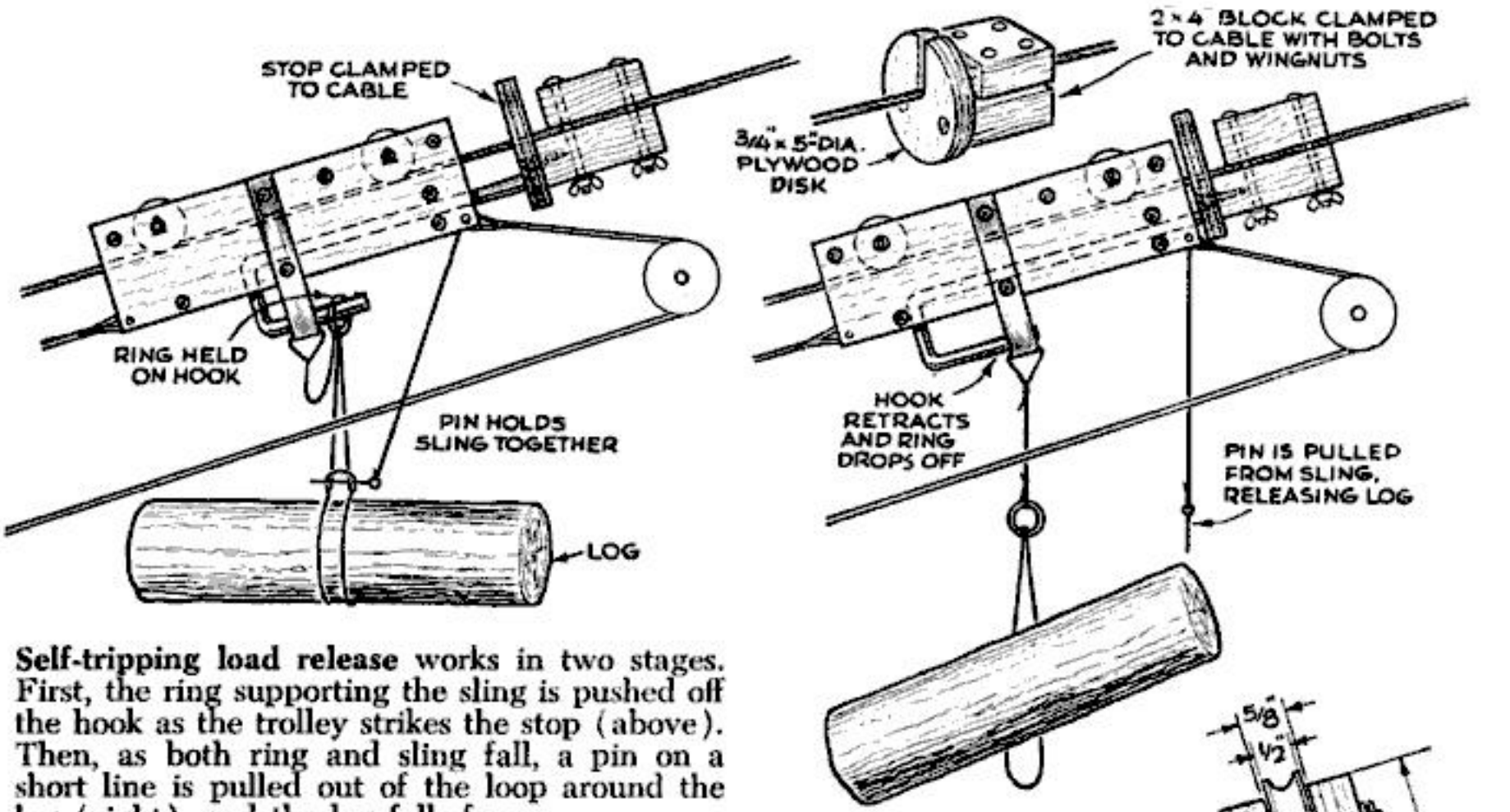
Self-Dumping Hoist for a Hillside

HOOK a heavy log onto this traveling hoist and it scoots up a hillside or across a stream at about 40 feet a minute. At the end of the line, the log releases automatically and drops neatly to the ground, right where you want it.

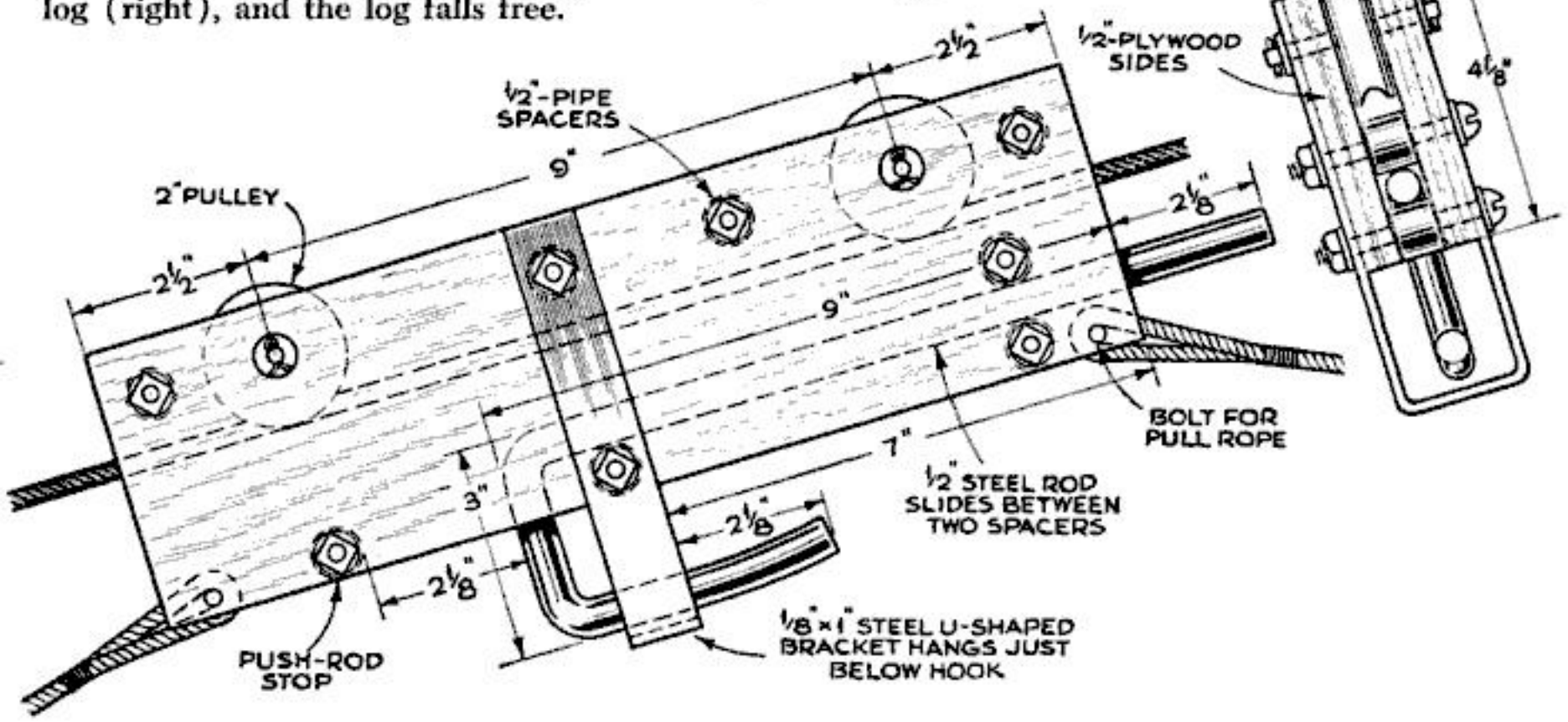
The unusual hoist was designed by G. A. Burrows of Burt, N.Y., to haul firewood and other heavy loads up a steep hill to his home. Burrows didn't want to have to keep running up and down the hill to release the load after each trip, so he devised an ingenious mechanism that releases the load by itself.

The carrier is a wheeled trolley that rides a ¼″ steel cable stretched taut between two trees. A ½″ rod, bent to form a hook, is free to slide back and forth along the bottom of the trolley. A sling to hold the load is tied to a ring that's slipped over the hook in the rod.

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Self-tripping load release works in two stages. First, the ring supporting the sling is pushed off the hook as the trolley strikes the stop (above). Then, as both ring and sling fall, a pin on a short line is pulled out of the loop around the log (right), and the log falls free.



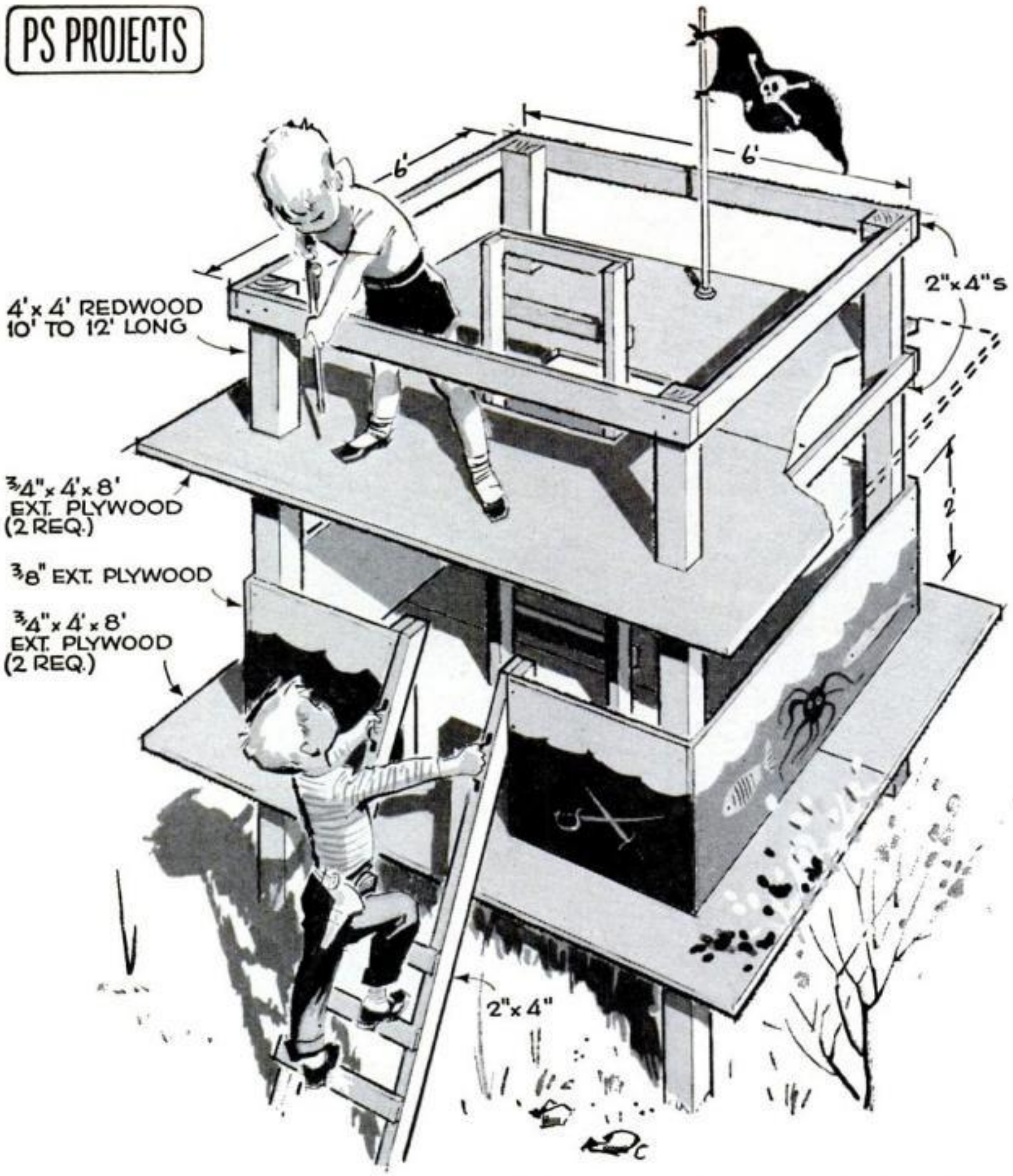
As the trolley nears the end of its run, the sliding rod strikes a stop block clamped to the cable. The trolley continues on a few inches, but the rod is held motionless by the stop—in effect sliding the rod backward in the trolley. The hook is pulled out of the ring, and the sling falls.

Now comes the tricky part: As the sling falls, a pin is pulled out of the loop, as shown above, releasing the log. The log falls free, but the sling remains attached to the trolley, ready for the next trip.

The hoist can be pulled by hand or, for heavy loads, can be powered by a small winch. Burrows uses an electric motor geared down to about 80 r.p.m. to serve as a capstan. The rope to the trolley is simply looped a few times around a large drum on the shaft and held taut while the motor does the work.

The sides of the trolley are ½" plywood spaced apart with ⅜" bolts through short sections cut from ½" pipe or tubing. The hooked rod rides on two of these spacers at the bottom, while a third spacer behind the hook serves as a stop to limit the rod's travel. The rod is held in its forward position by friction under the load's weight until it strikes the stop and is pushed backward. As it retracts, the sling-supporting ring is then pushed off the hook by the U-shaped bracket surrounding the hook.

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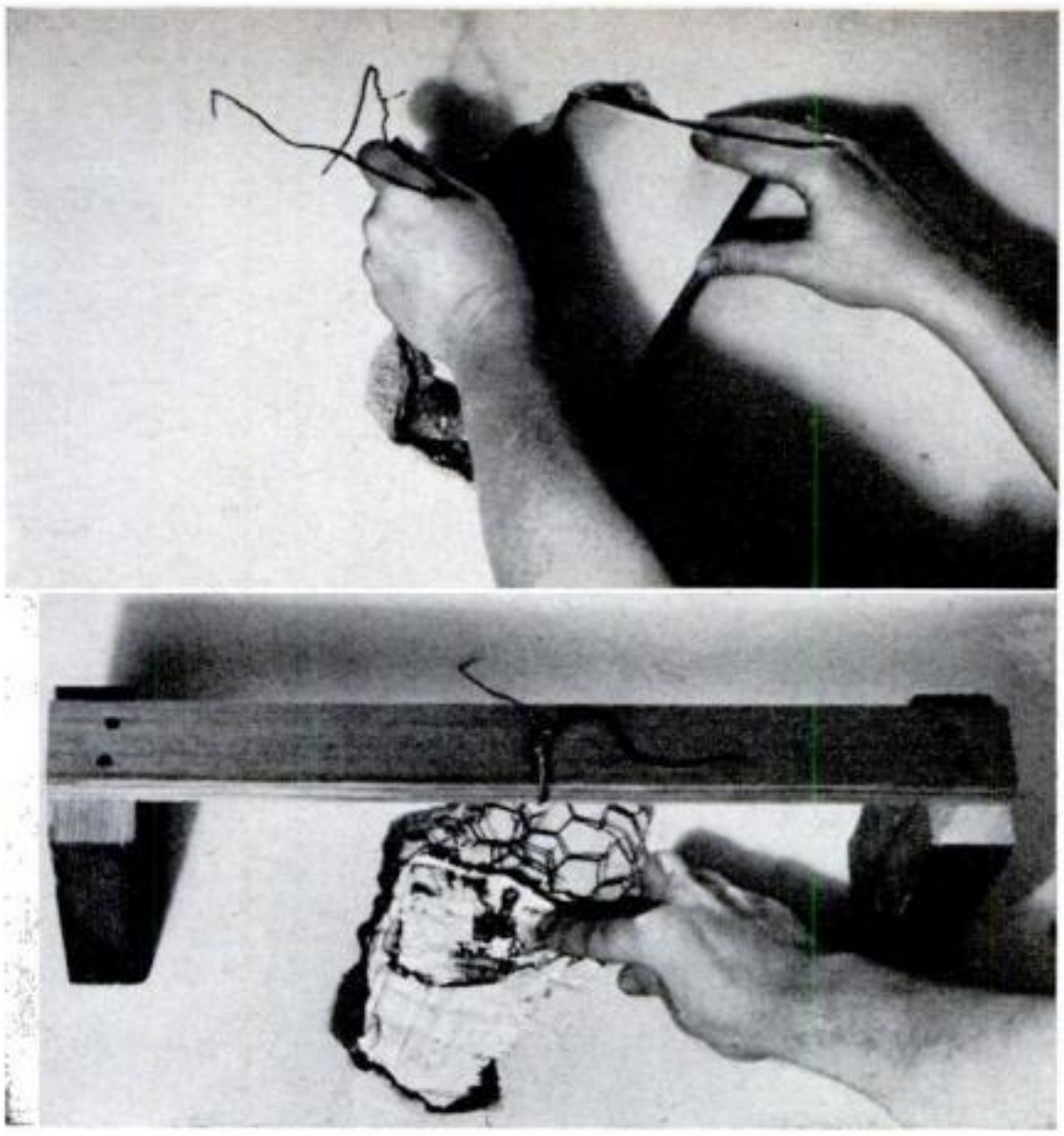
Play Center for Young Imaginations

By James A. Dever

IT'S a fort. It's a space platform. It's the bridge of a ship—or anything small fry can dream up for their make-believe world.

Begin the simple construction by sawing out 4"-by-4" openings in the upper and lower decks to accept the four vertical posts. You can use one of the pieces to mark the spacing of the postholes. The posts should be set about two feet in the ground. You may want to decorate the lower guard panels before nailing them to the posts. Metal drawer pulls screwed to the outside ladder will give the kids a handgrip. When building the center ladders, space the rungs so the youngsters can scramble up and down quickly and safely. A couple of coats of bright exterior paint finishes your play center; I used different colors and imaginative decorations. If you paint the floors, use a good deck enamel.

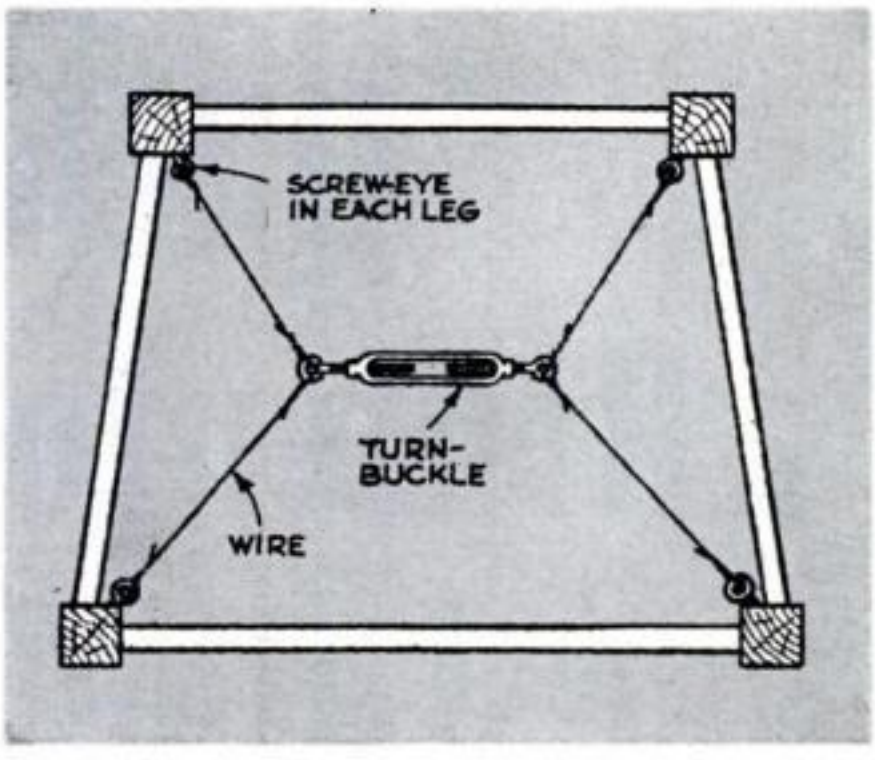
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Bridge gives support for patching plasterboard

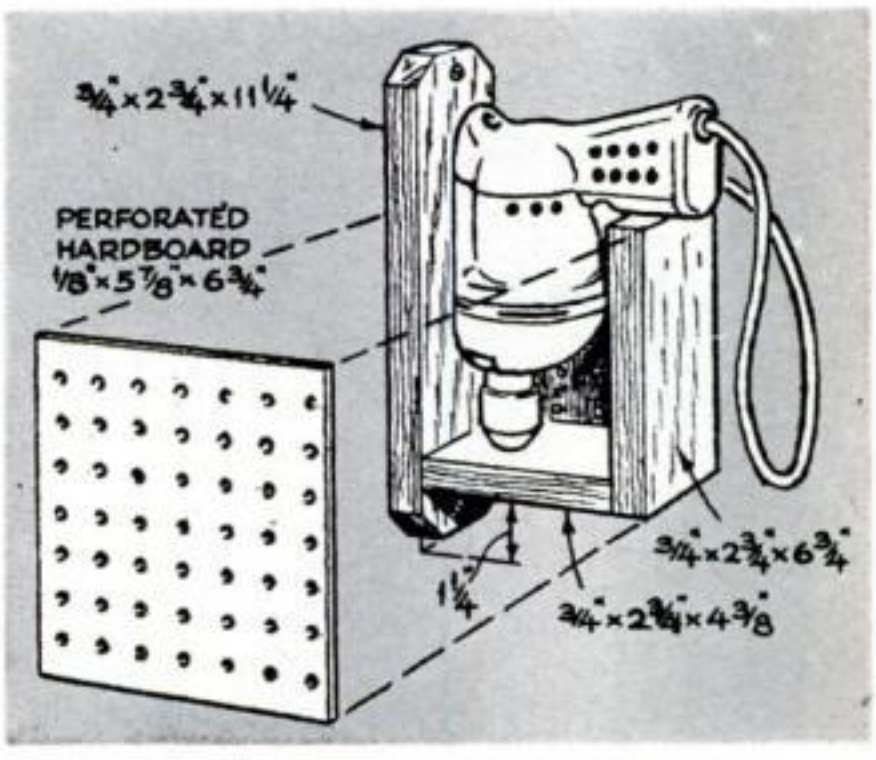
Here's a way to hold backing in place when you patch a large hole in plasterboard. A bridge (lower photo) and a wire hold scrap plywood behind the edges of the hole until the final bond. Drill two holes in the plywood and pull an 18″ wire through. Insert the plywood and wrap the wire around the bridge. Place chicken wire in the hole, and apply the first coat. When it sets, scratch the surface for more grip. Snip off the wire and apply the final coat of plaster.—*Henry V. Lukas, Los Angeles.*

▶▶▶ To clear a clogged kitchen waste pipe, screw a clincher coupling on the end of a garden hose. The coupling's flexible fingers will allow you to use either end. Turn the cold water on full force to make the hose as rigid as possible. Push and wiggle the hose down into the drain. The clincher fingers will claw out the obstruction and flush the debris down into a larger part of the wastepipe.—*John Calder, Laurel, Md.*



Chair tightening made easy

The seats of most wooden chairs can be tightened easily by the method shown in the drawing above. The only materials needed: four screw-eyes, wire, and a turnbuckle. Place a screw-eye in each leg. Run the wire from the top screw to the bottom one on each side. Attach the turnbuckle and tighten.—*A. E. Amos, Fort Wayne, Ind.*

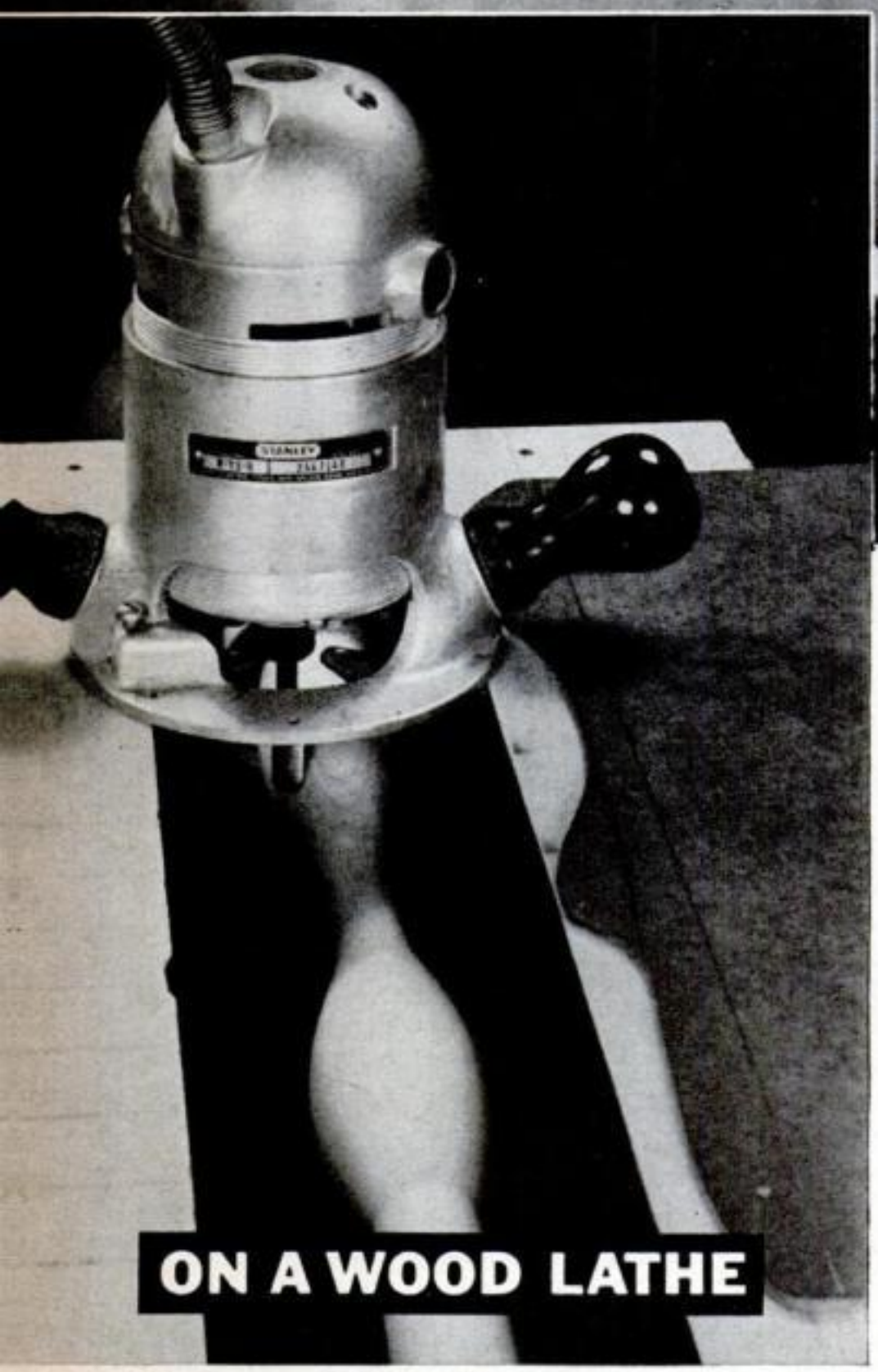


Holster protects electric drill

Simple to build from scrap wood, this holster protects your ¼″ electric drill and also makes it readily available for use when fastened above the workbench. Small changes in measurements can be made for different size bits. A slice of foam rubber on the bottom protects the chuck from damage.—*Eric E. Swanson, Whittier, Calif.*

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PS TOOLS



Shaping spindles with a router works best when the cutting tool contacts work about 45 degrees forward of the vertical centerline. Cut material away in easy stages until you can make one final, light sweep with router base held in full contact with the template.

Hitch a Router to Your Lathe!

With this setup you can turn exact duplicates using a template—and do other surprising tricks, too

By R. J. De Cristoforo

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ON A METAL LATHE

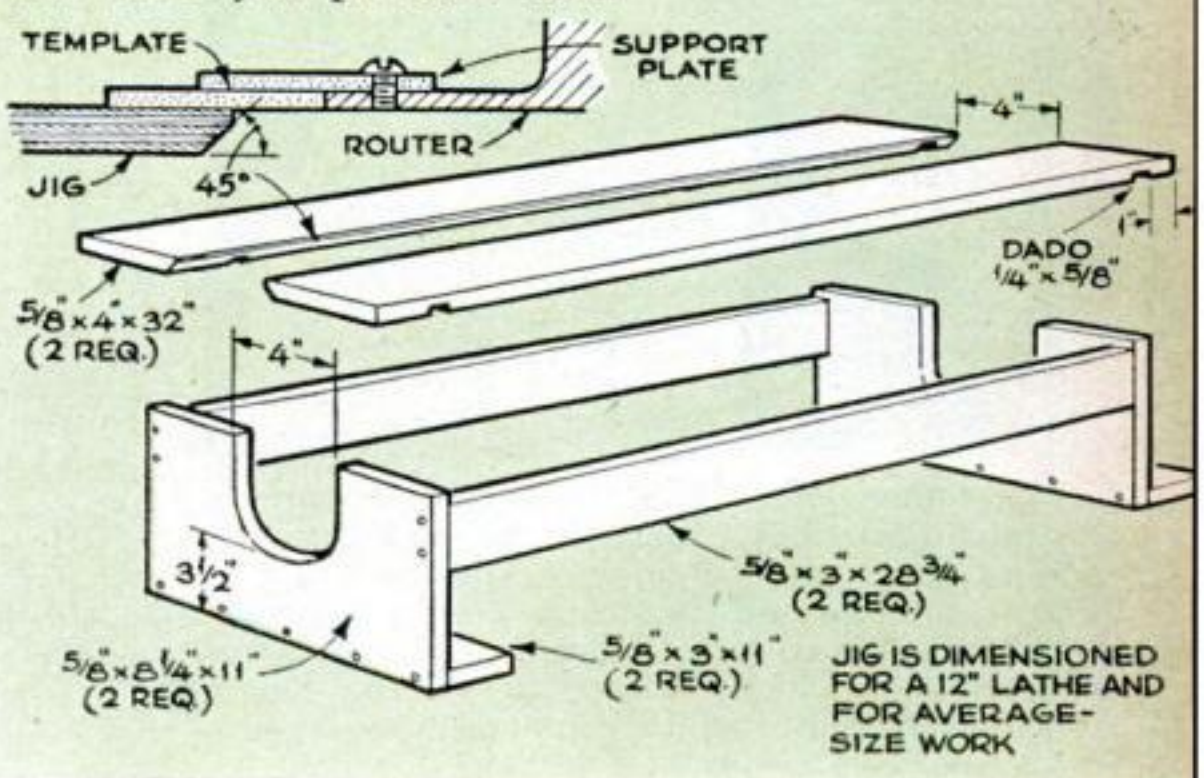
USING the fast-spinning cutter of a router instead of the single edge of a wood-turning chisel opens up a whole new world of possibilities for turned-wood projects. The system works equally well for shaping wood turnings on a metal lathe or a wood lathe. Once you have made the simple jig shown here, you can:

- Quickly turn several dozen identical spindles for a project such as a deacon's bench or a spoke-back chair.
- Turn sections that would be too slender and limber to handle with a conventional chisel.
- Easily turn long, perfectly true cylinders or cones almost automatically.
- Cut uniformly shaped and spaced flutes or facets.

You make the jig from ¾" ply-

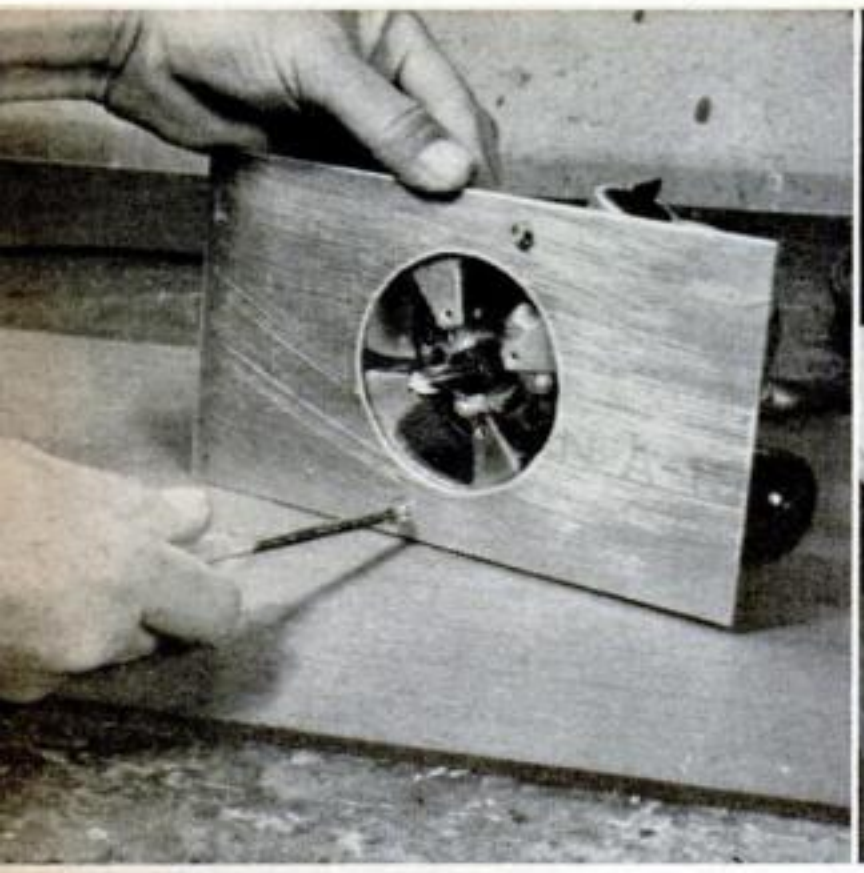
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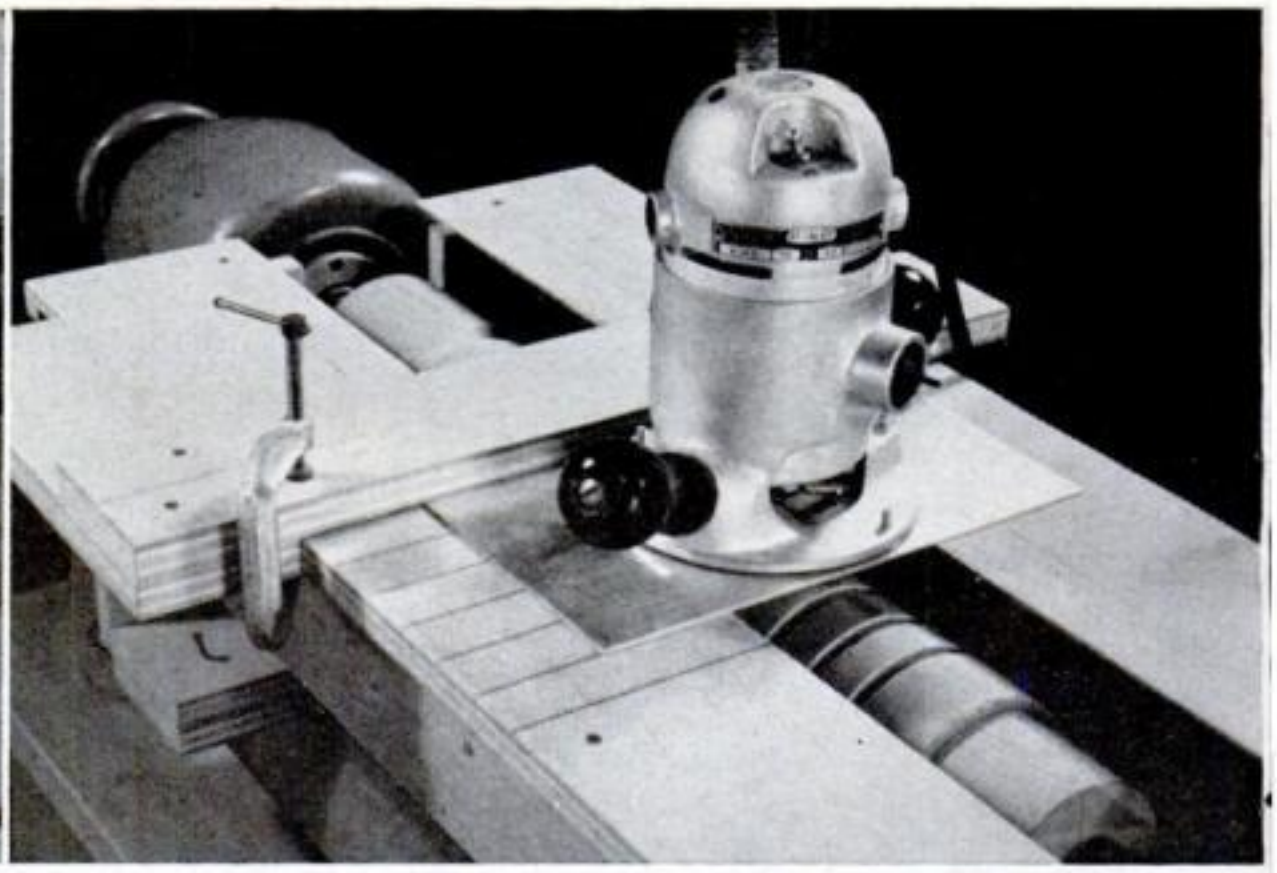
The router method of wood turning works equally well on a metal lathe. The general design of the jig for both metal and wood lathes is shown below. Choose dimensions that will fit your particular lathe.



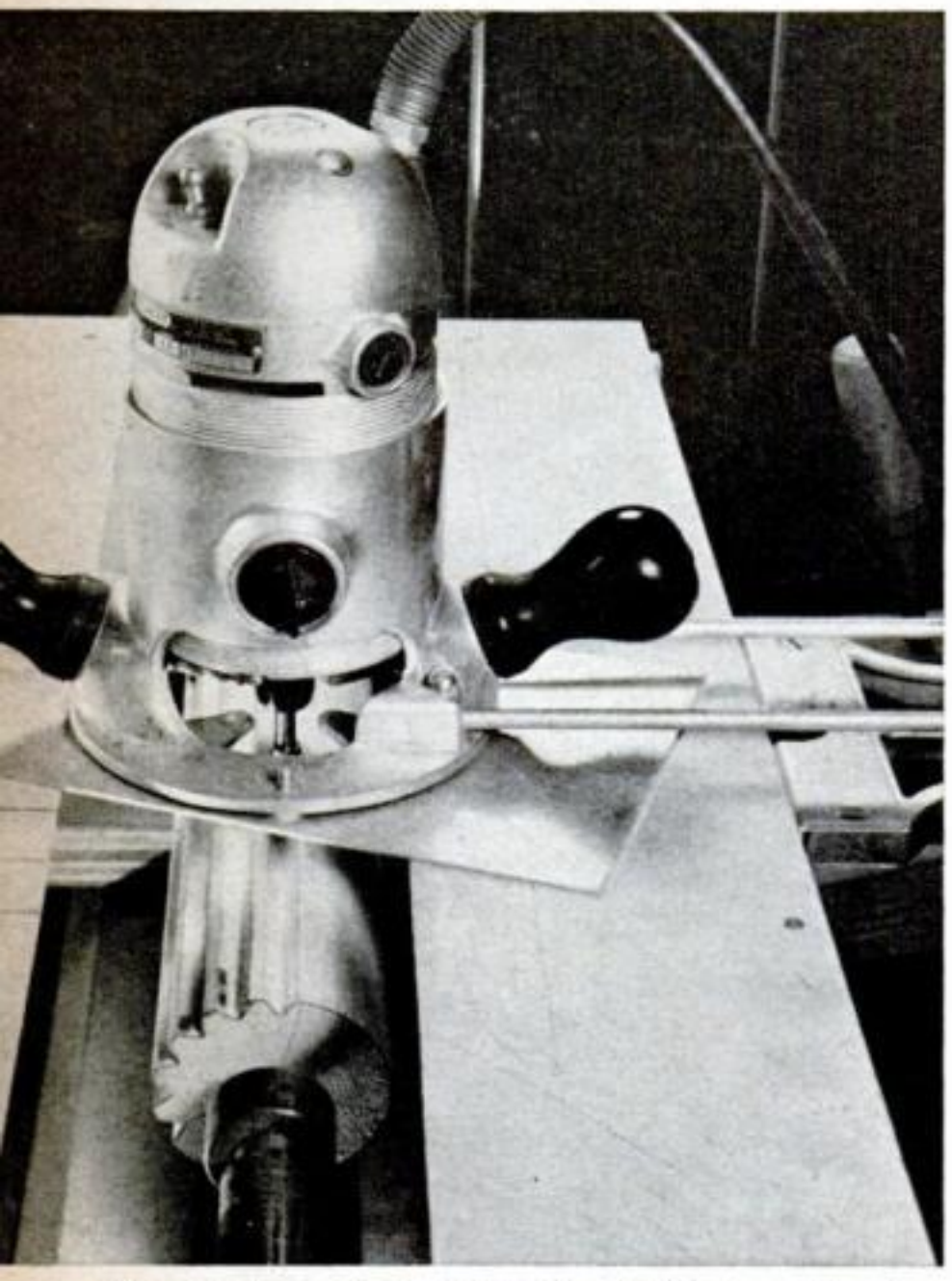
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The router brings new possibilities for spindle designs





To increase versatility of the router turning-jig, fasten a stiff sheet-metal auxiliary base to your router. To form perfect grooves or bands, make an L-shaped guide and clamp it to the jig. Mark lines on jig for accurate spacing that can be repeated on as many pieces as you may want to make. Adjust router for depth of cut; feed into the cut from front to back.



Use router edge-guide for fluting or turning straight cylinders. Adjust router and cutter to work exactly on centerline of workpiece. Lathe, of course, would be running when turning cylinder—locked with indexing device to space flutes. Stop block clamped to jig fixes length of flutes. Flutes and peripheral grooves can be combined to produce a faceted effect.

wood. Parallel top rails are about 4″ wide, spaced about 3″ apart; their top surfaces should be about 1½″ above the lathe centers for most work. A core-box router cutter will work best for most jobs. Ordinary countersink bits and rotary-file burrs can also be used for special work. Straight router cutters should be used for turning straight cylinders; fluting and grooving.

Clamp the jig firmly to the lathe bed. Adjust depth of cut on the router so that the cutter will touch the stock about midway between the horizontal and vertical centerline when the router base is resting on the top rails of the jig. With the lathe turning at about 1,000 r.p.m., move the router slowly from left to right, removing no more than about ⅛″ of stock at a pass.

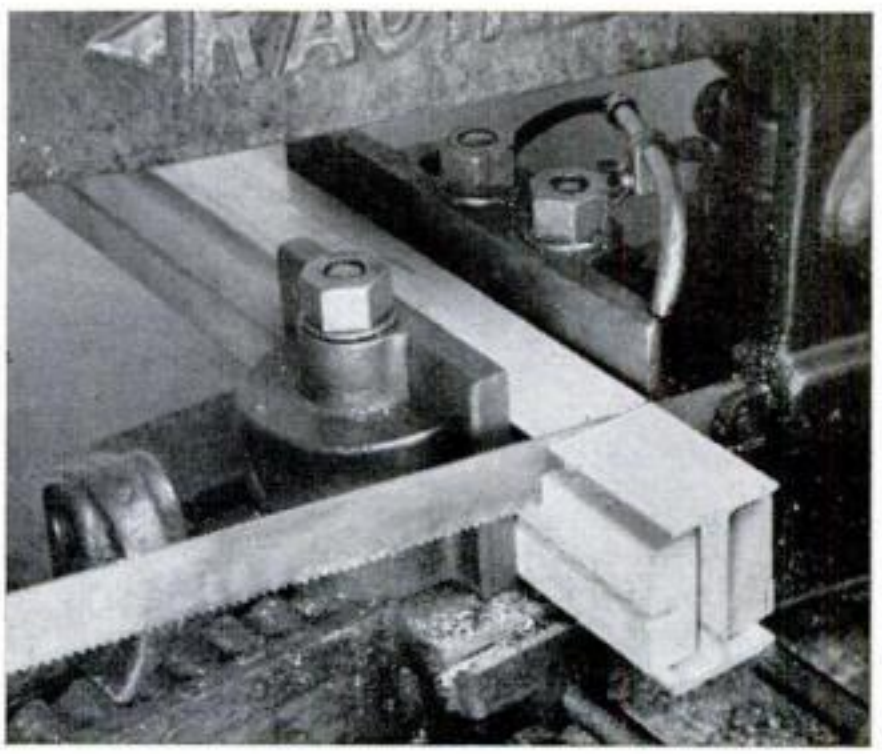
To mass-produce duplicate spindles cut a template from tempered hardboard. Mount your sample between lathe centers. (If necessary, turn up a sample freehand in the usual fashion.) Clamp a strip of hardboard to the jig's rear platform. Use the router as a marking gauge by moving it along the spindle (neither router nor lathe, of course, should be running) with cutter held in contact with the sample while you trace the contour on the hardboard with a pencil. Saw out the contour and clamp the template back on the jig. The template will now guide the router to produce the proper contour as you move the router along the jig. ■■

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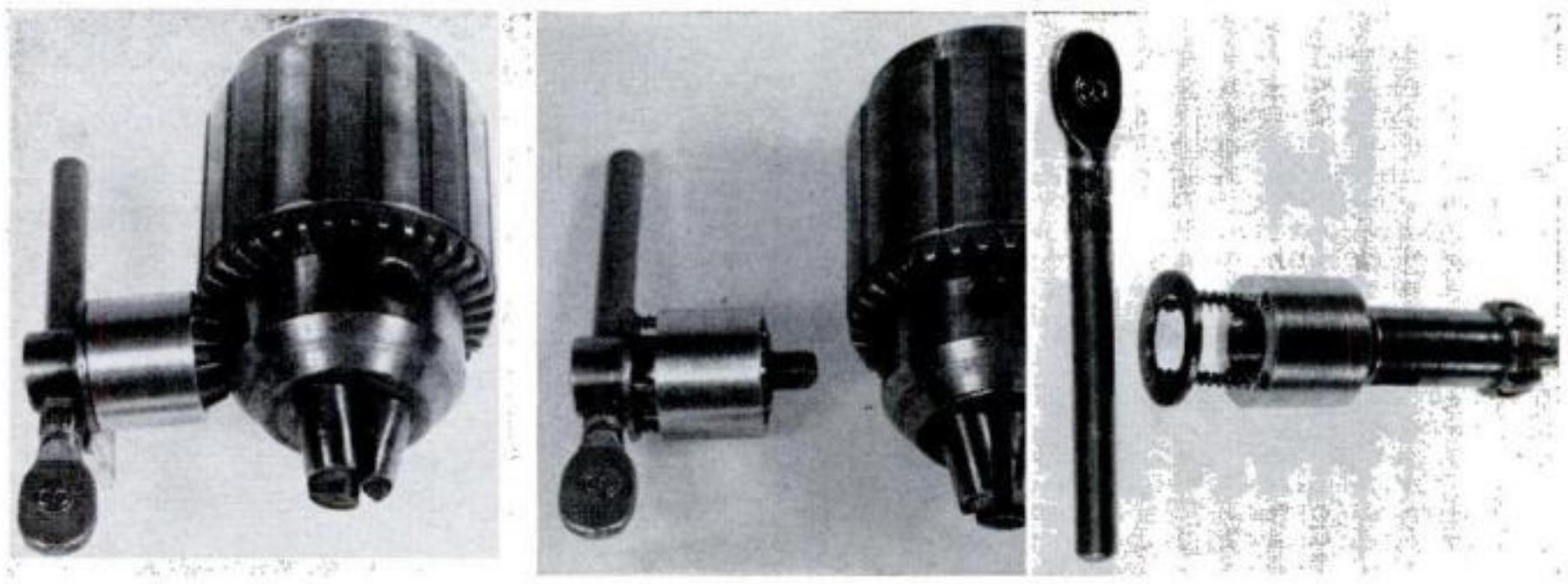
Scrap conduit for shelf brackets

When I built a storage area in my basement, I needed several heavy shelf brackets to support all the supplies. I found it possible to save money by using scrap electrical conduit. I cut the pieces to the required length and crushed the ends flat in a vise, bending the end sections to the proper angle at the same time. Then I drilled the ends to accept screws. With the shelving nailed to the wall, the brackets support a considerable weight.—*E. F. Lindsley, East Troy, Wis.*



Buffer blocks prevent breakage

Sawing a piece of aluminum or similar material on a power hacksaw is risky unless you use a fine-toothed blade. Often the blade breaks or some of the teeth are damaged, making ragged edges. Here's my solution: I clamp two buffer blocks (preferably scrap hardwood) to the sides of the metal strip so the blade is forced to cut through a greater mass. Then I can saw through the metal-wood sandwich with ease and the blade doesn't chatter or vibrate.—*H. J. Gerber, Menomonie, Wis.*



Modified Jacobs-chuck wrench

A chuck wrench left in the drill press can injure you or cause damage when the drill is started. I made this modified wrench so it would fall out of the chuck unless held in place. The photograph at left shows the wrench held in position. In the center picture, the wrench is shown as it falls free of the chuck. The photo at right shows the wrench and handle, which holds the spring assembly together. The device consists of a washer, four pins, and four springs equally spaced. The idea adapts easily to independent four-jaw or three-jaw chucks.—*C. Gibbons, Greenwood, Nova Scotia.*

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CAR-TOP CARRIER



CAMPER TENT

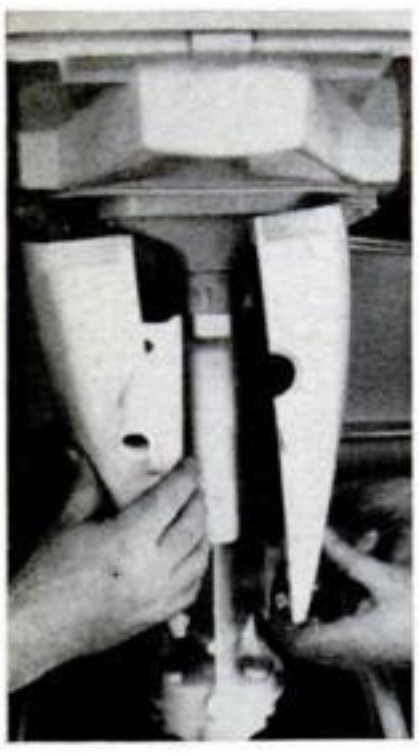


BOAT

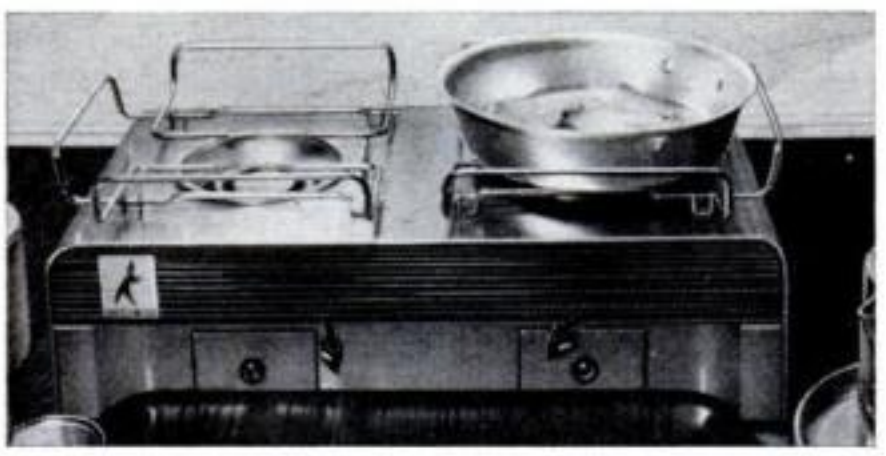
Car-top unit is all-around handy

Handy Andy is a shallow-draft boat, car-top carrier, and tent all in one. As a boat, you can row it or power it with outboard motors up to 10 hp. An attachment with screened windows and zippered doors turns it into a tent for two. As a carrier, it gives 30 cu. ft. of cargo space. It's $248 from Go-Go Industries, 1509 Chicago St., Omaha, Neb.

"Hollow leg" quiets outboard



Several models of West Bend's 1963 line of outboard motors come with a silencing shield around the leg of the motor's outboard shaft to reduce motor noise. It is standard on the 20-hp. and 45-hp. models, costs $14.95 when added to the economy 30-hp., replacing the standard exhaust relief plate. West Bend Co., Hartford, Wis.

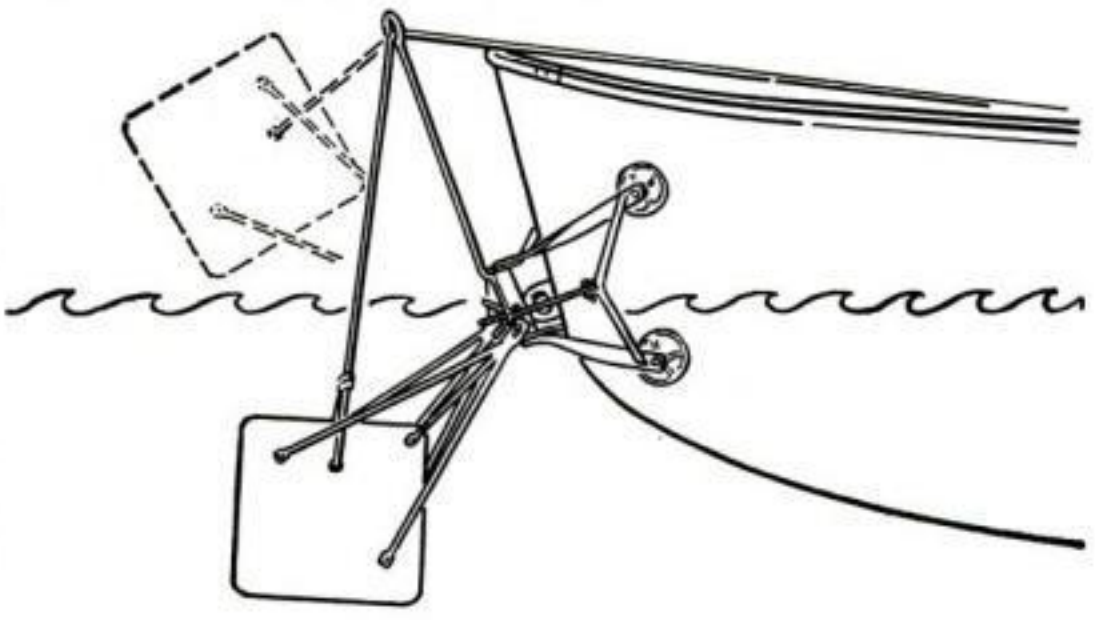


Solid-fuel galley stove is spillproof

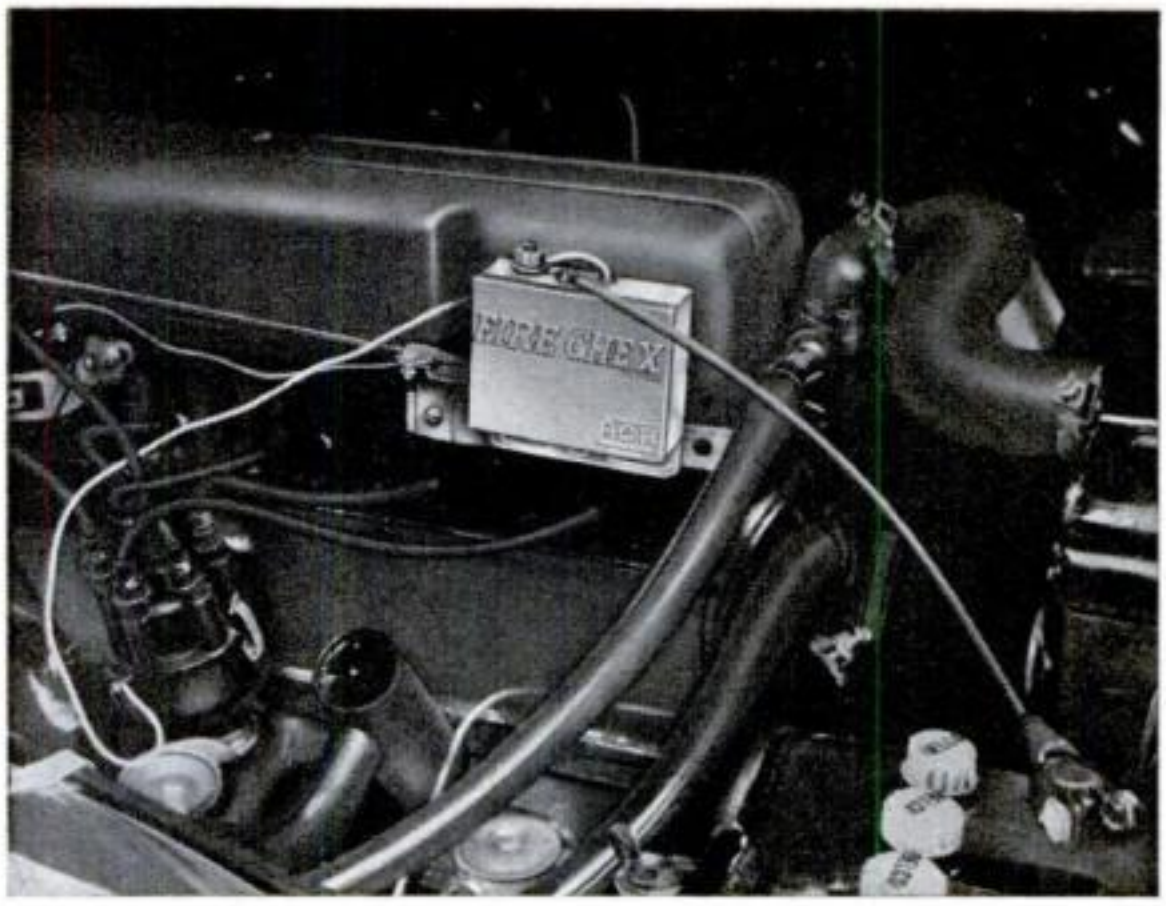
Sportsman's galley stove is designed to eliminate spillage, fumes, and flare-ups. A two-ounce can of solid fuel burns for four hours. In aluminum or stainless steel, single or two-burner: $32.50 to $72. Merriam Mfg. Co., Durham, Conn.

Bow-control rudder takes zigzag out of trolling

This Trol-Control bow rudder is designed to keep the bow of your boat on the straight and narrow, resisting wind action while trolling. It's easily attached to bow eyebolt; braces go up against bow. A light line permits lifting the rudder when beaching. $12.95. Arco Mfg. Co., Box 817, Grand Forks, N.D.



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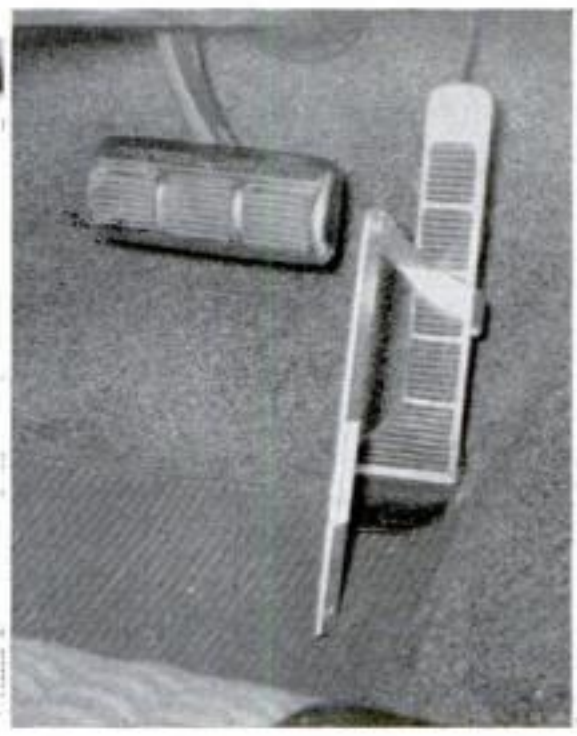
Ignition cutout prevents fire

In a crash or roll-over, Fire Chex automatically shuts off current to prevent fire. A dash-mounted knob lets you switch off all juice, to keep children from starting the engine or turning on the radio. ACB Corp., 215 N. Cole St., Lima, Ohio, sells it for $19.95.



Extra signal warns when directionals are on

Here's an answer to directional signals that don't click or aren't loud enough: Turn Alert. Its clicks can be adjusted for loudness so you won't forget to turn off directionals after very shallow turns. Ethical Enterprises, 988 U.S. Highway 202, Somerville, N.J. $4.95.



Gas-pedal prop replaces hand throttle

With the Engine Idler on the gas pedal, you can set idle speed as high as you want for warming up or tuning the engine. Squeezing jointed bars wedges the rear one against the floor. Leiter Mfg., Box 752, Saginaw, Mich. $1.49.



White stripes dress up blackwall tires

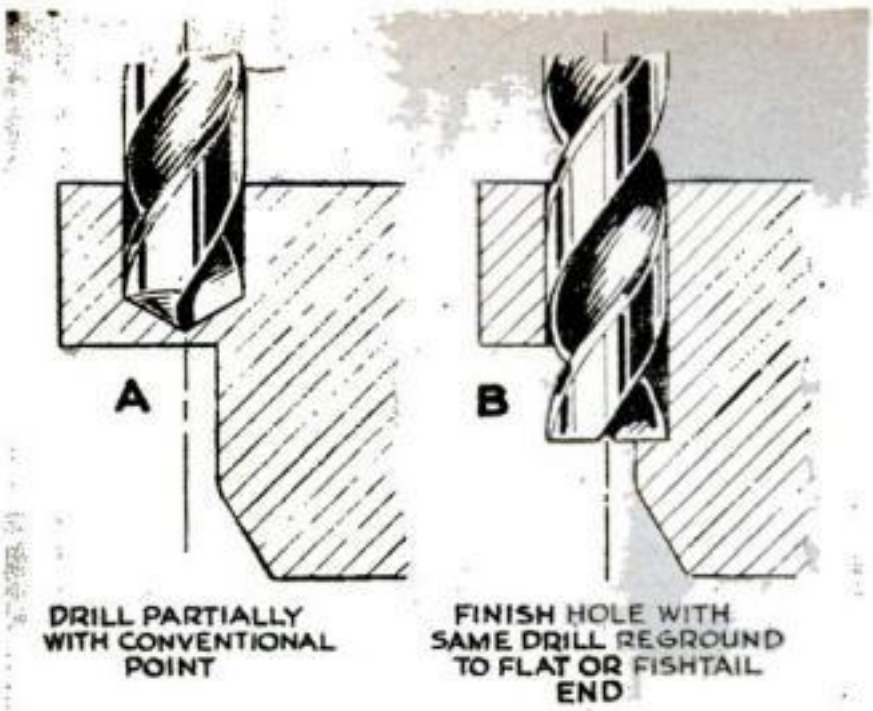
Dual-striped white sidewall toppers look like real whitewalls, but snap in place between tire and wheel rim. Stripes are $\frac{3}{4}$" and $\frac{3}{16}$" wide. Four toppers for 13", 14", or 15" wheels cost $6.75. J. C. Whitney, 1917 Archer Ave., Dept. 70, Chicago, says they'll stay white.

Bug deflector protects windshield

This transparent full-width deflector keeps your windshield clear of bugs and snow and protects it from stones, says the Deflecta-Shield Corp., Corydon, Iowa. The Plexiglas shield mounts on the hood with an aluminum channel. $14.95 for 1961-63 cars, 1962-63 pickups and medium trucks.



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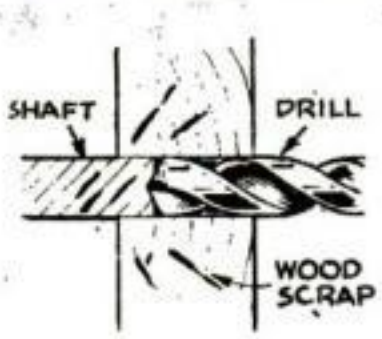
Grinding a drill to "cut air"

It's hard to drill a straight hole in a situation like that in sketch A, above. When the drill breaks through and "cuts air" on an open side, it invariably drifts toward one side, resulting in a bent or broken drill and a crooked hole.

Here's the solution: First drill only as far as there is solid metal. Before the drill breaks through, regrind the point so that the lips are flat. With the hole as a guide, the drill will then go straight, as in B.—*H. J. Gerber, Menomonie, Wis.*

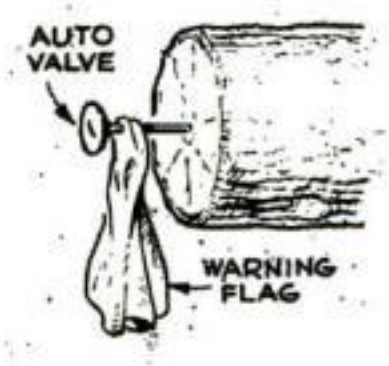
Centerdrilling a round shaft

You can centerdrill a round shaft without a lathe if the shaft happens to be a standard drill size. Just drill a hole of the same size as the shaft through a piece of scrap hardwood. Insert the shaft in one end and run the drill long enough to make a slight depression. This will be the exact center.—*W. Rasmussen, Prosser, Wash.*



Old valve spikes warning flag to log

We followed several logging trucks on our vacation trip to the West Coast last summer. I noticed that these truckers frequently used a sharpened engine valve to spike a red warning flag to the end of a log. The big head of the valve serves better than a nailhead to keep the flag from working off.—*John Krill, N. Lima, Ohio.*



Does Your Boat's Tail Drag?

try the new trim tabs

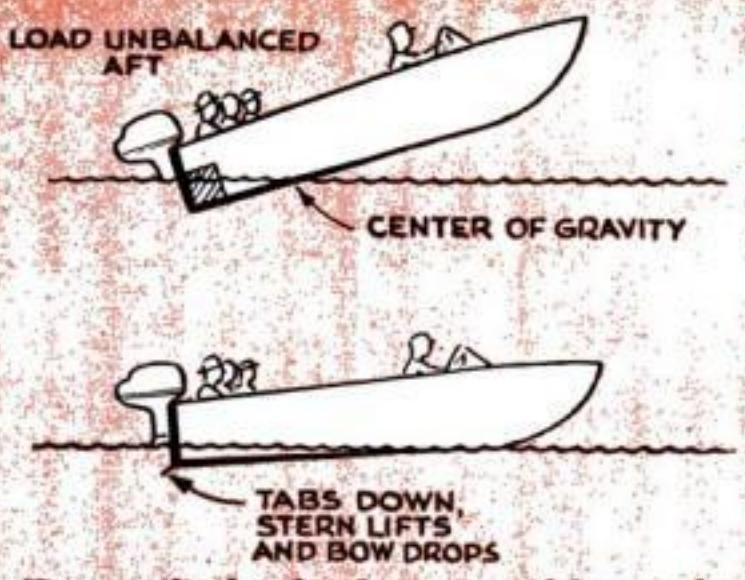
By Jerry Martin

ONE of the hottest new wrinkles in boating this year, the trim tab, is borrowed straight from modern aircraft. Trim tabs are small, adjustable flaps hinged to the stern of a boat just like the trim tabs in an airplane's wings and tail. As the tabs are tilted up and down, their pressure against the water forces the boat to change its planing angle just as the tabs on an airplane adjust its trim.

The big advantage: The tabs let you adjust a boat's planing angle for maximum speed and efficiency as weight distribution and water conditions change. Passengers often congregate too far aft where the engine, fuel tanks, heavy batteries, and other gear are already weighing the boat down. Result: The hull becomes tail-heavy. The stern digs into the water, and the drag steals precious speed.

With a pair of trim tabs tilted down, the stern is forced up, the bow comes down, and the hull flattens out and picks up speed. It's what an outboard racing driver does when he leans forward during accel-

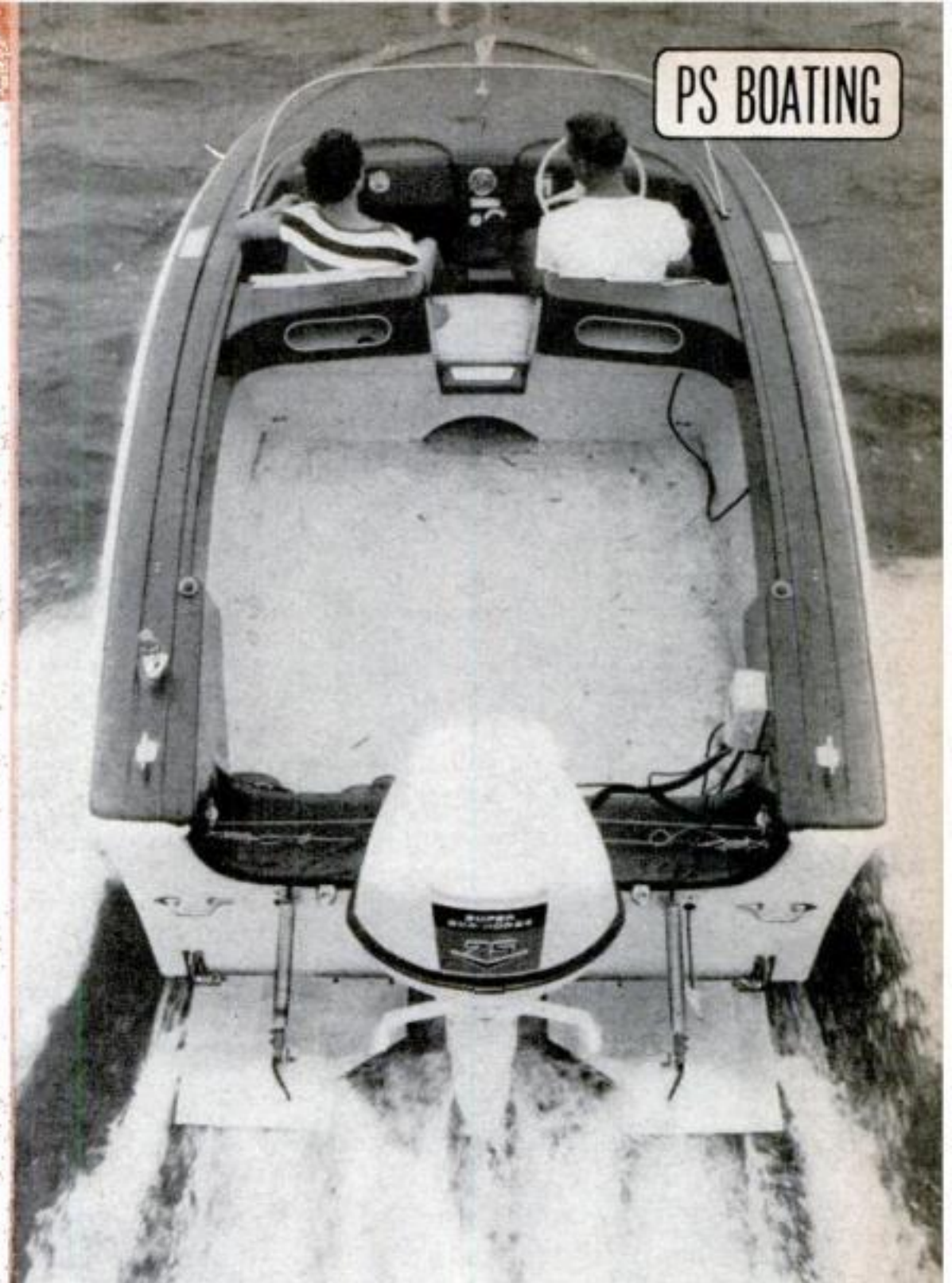
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Down-tilted tabs force a tail-heavy boat to lift at the stern and ride flatter and faster. Plane-O-Matic tabs at right are automatically controlled by CO_2 gas.



Yawing caused by engine torque is corrected by tilting down the tab on the same side as the yaw. This counteracts prop's tendency to steer boat in an arc.



eration to get his craft up on plane fast.

As the boat begins to plane properly and you need less stern lift, you ease the trim tabs back up. If your passengers change their seats or you take on an added load, you readjust the tabs to keep the boat riding at the correct attitude at all times.

Types of trim tabs. An early form of the trim tab was used years ago, but only for limited applications. Known as a "wedge" or "shingle," this was a fixed ramp fitted to the bottom of the hull to provide a slanted plane. Being nonadjustable, it was used mainly to correct basic faults in hull construction.

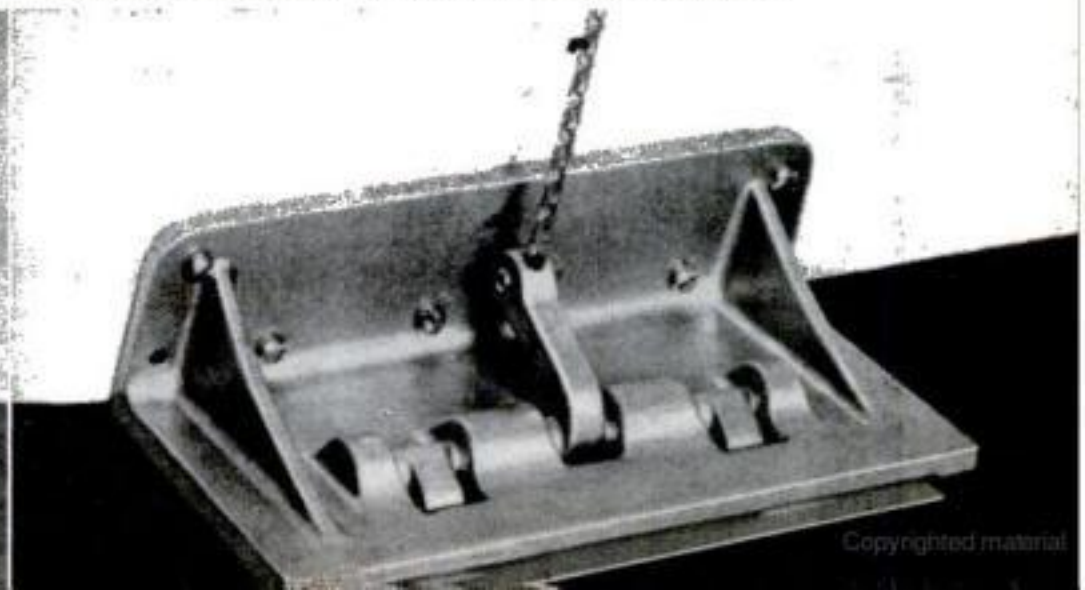
With the new tabs, the angle can be varied to suit the changing conditions that affect any boat. In the simplest type, the angle of tilt is set with a wrench; it's not designed for quick adjustment while the boat is in motion. You get the proper angle by making a series of test runs, and then leave the tabs permanently set. These sell

[*Continued on page 163*]

You use a wrench to adjust this inexpensive type of trim tab, then leave it set. It's ideal for a fishing boat where the driver usually sits aft, making the boat chronically tail-heavy.



Remote-controlled trim tab is operated by a crank-and-cable arrangement, can be adjusted at will from driver's seat. This type, made by Tempo Products, sells for $42.50 a pair.



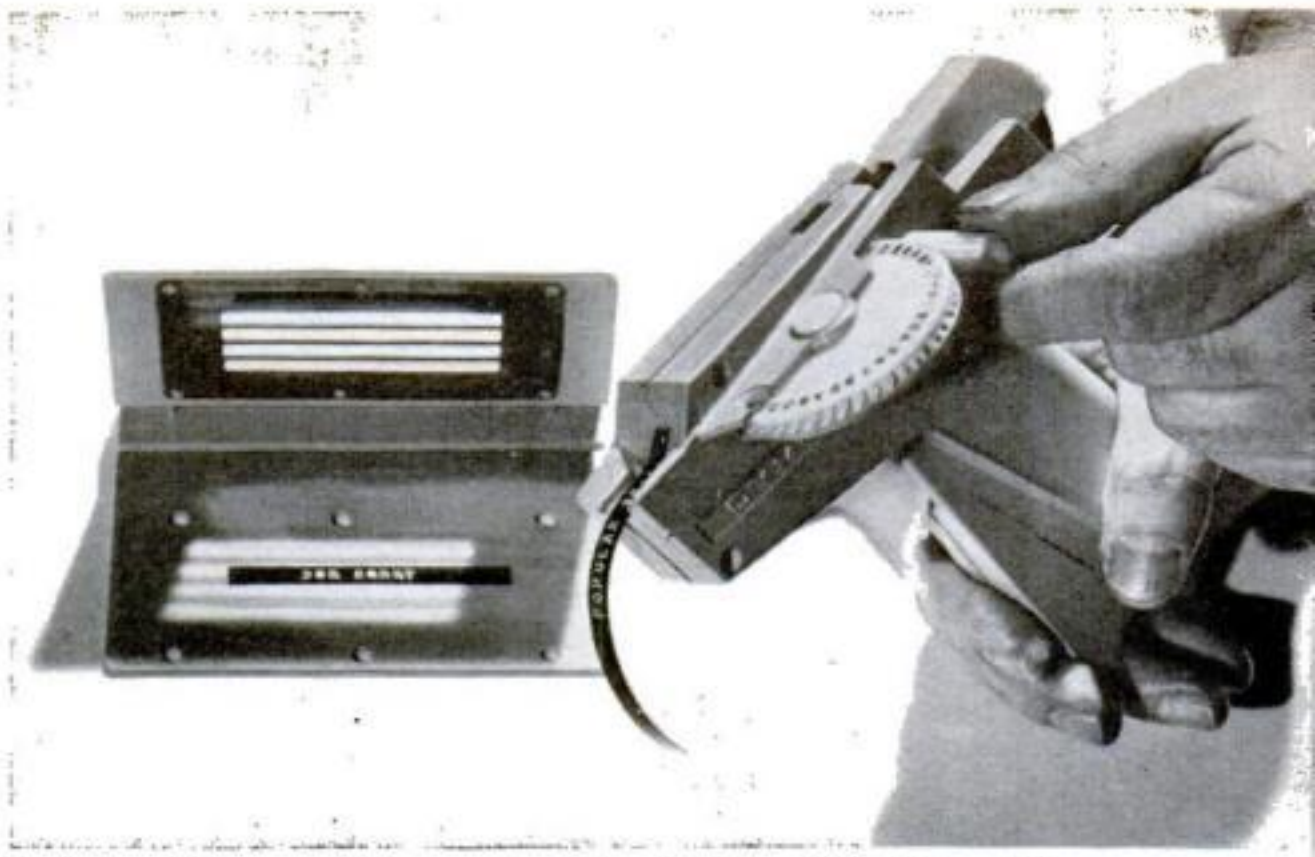
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what's new

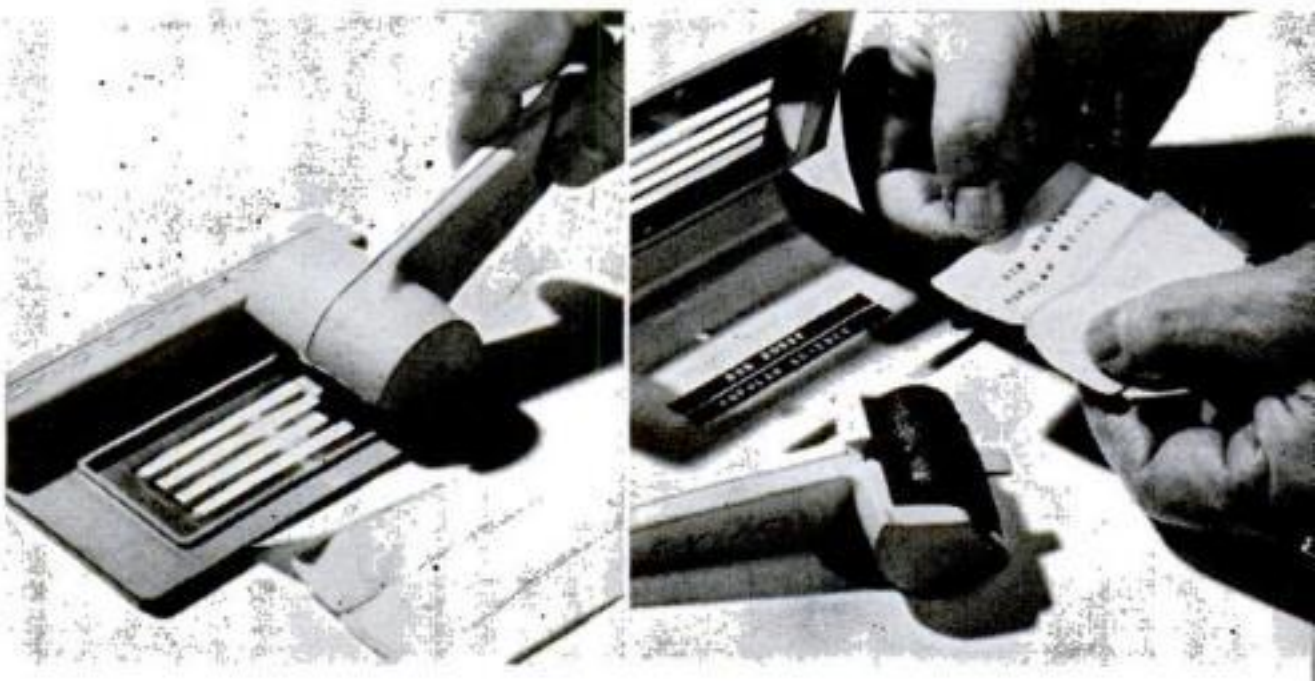
Printers Put Labels on Tape or Cloth

TWO printers take care of all your labeling needs. One embosses names and other identification in raised white characters on black or colored adhesive tape. It's a simpler, tough-plastic version of an earlier metal model [PS, July '61], sells for $9.95 with three six-foot magazines of tape: red, black, and gold. Extra magazines are 75 cents each.

An accessory is a printer for iron-on cloth tape or a sheet corner or shirt-collar band. Up to four lines of embossed tape are placed in a holder, cloth put on top, and indelible ink rolled on. It costs $5.95 with an assortment of labels. Dymo Industries, Box 1030, Berkeley, Calif., makes both.



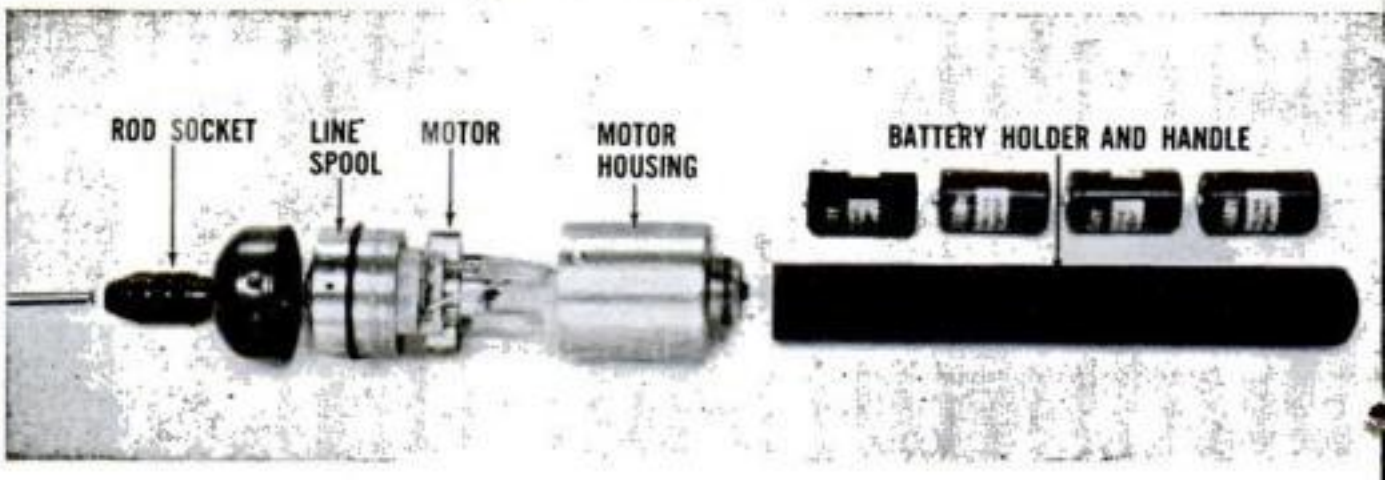
Label-making machine works like child's old-fashioned typewriter. You dial character wanted, squeeze handle, and it prints, automatically moving tape another notch. To transfer marking to iron-on labels or other cloth, you insert embossed tape in holder, clamp cloth on top, and roll on indelible ink (below). Ink then shows only on raised part of cloth.





No-crank fishing reel spins on batteries

An electric motor in the handle of this rod reels in your catch for you at the push of a button. The motor disengages for casting and will reverse under severe tension, automatically letting a fish run. Operation is either by four batteries or from your boat's 12-volt power system. Lectromatic Sports, Inc., 11405 E. Seventh Ave., Denver, Colo., has three models, $39 to $50, depending on the style of fiberglass rod you choose.



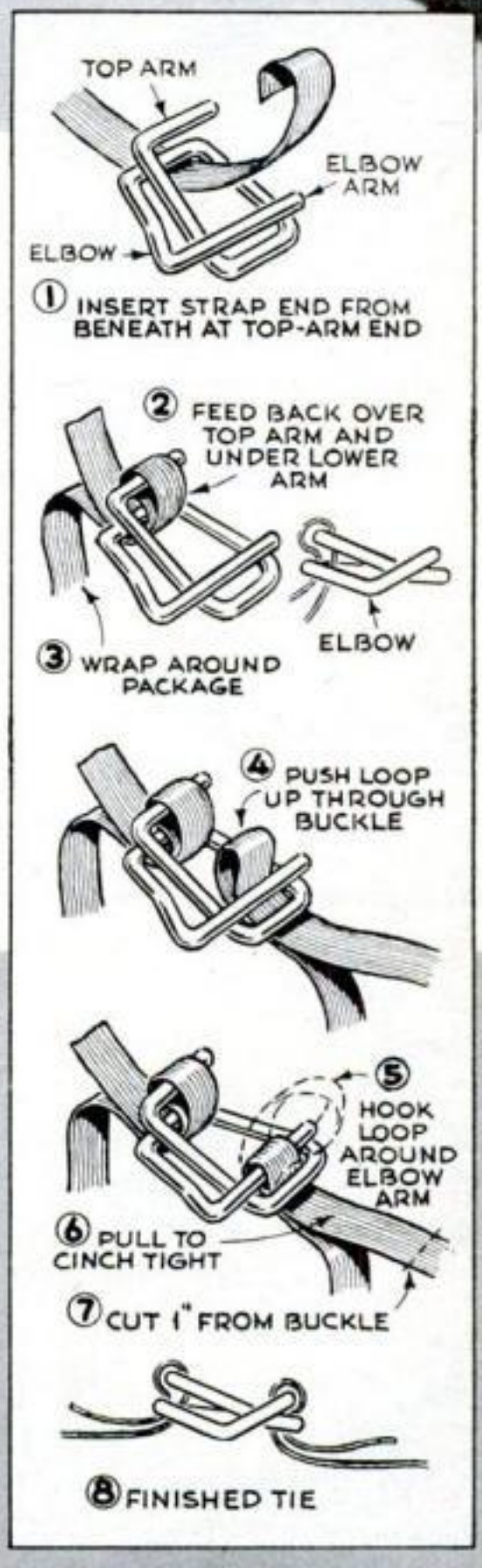
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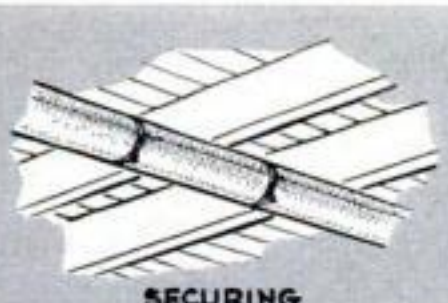


Rayon Tire-Cord Strap Ties Without Knots

YOU can now get commercial-type, high-strength rayon strapping for wrapping jobs around the house, shop, and vacation spot. Uses range from securing boat bumpers and car-top loads to clamping glued work and wrapping packages. Handi-Strap is a ¼"-wide tape that won't cut hands, adapts to any shape, doesn't damage edges, holds without knots, and can be cinched tight without first being loosened. Ends are held together with bent-wire buckles.

American Viscose Corp. now packages 100′ of rayon strapping and 30 buckles for home use. A card of the material is about $1.50 at retail stores.




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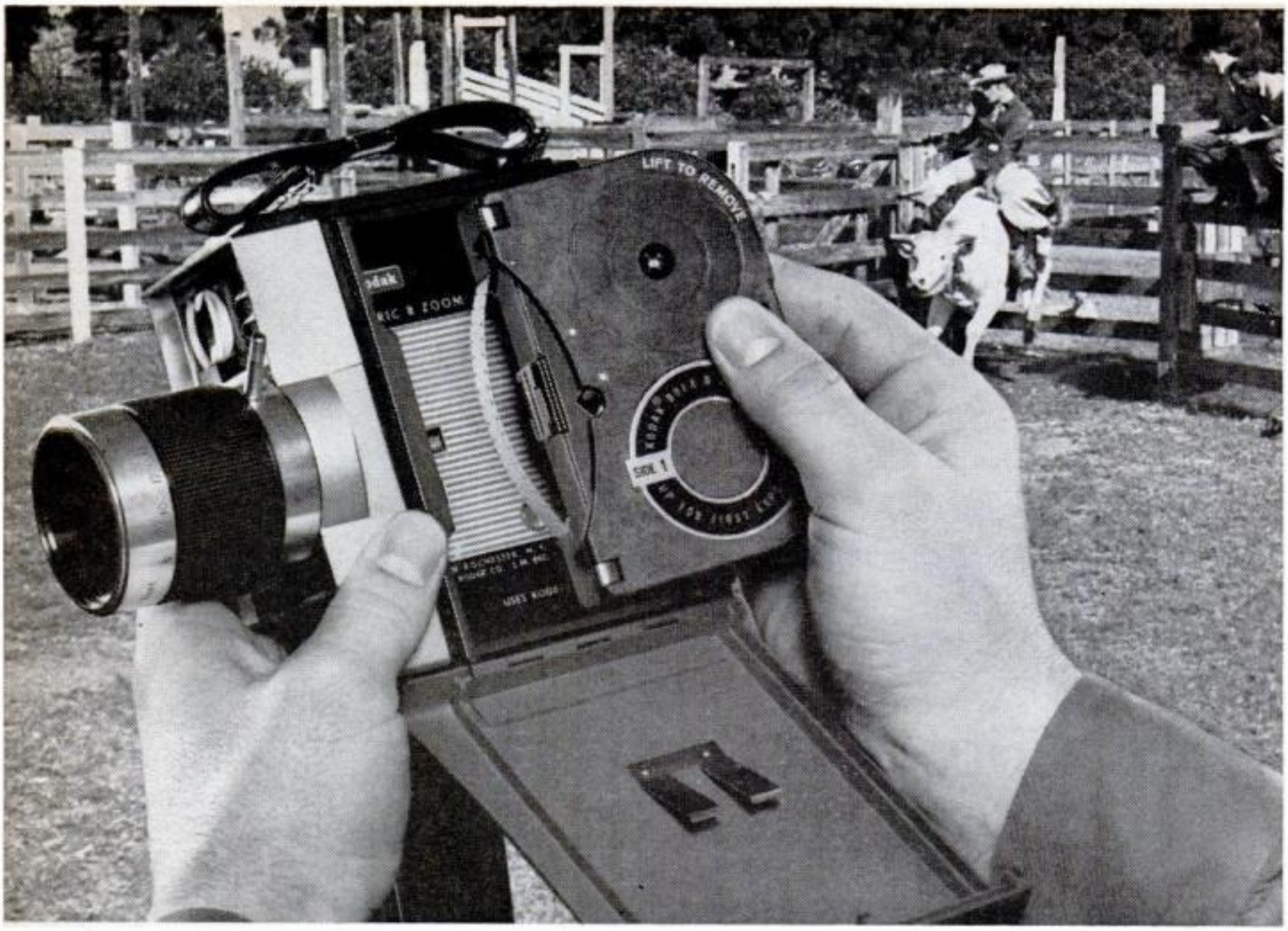

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-Patrick-

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Fast, drop-in loading with new KODAK DUEX 8 Cassette

New KODAK Electric 8 Zoom Camera

Gives you the drop on

New fast loading, plus battery drive and electric eye keep you always ready to shoot!

You don't miss any action with this camera. It uses regular 8mm film—in the handy new KODAK DUEX 8 Cassette which just snaps into the camera. At the end of the first 25 feet, flip the cassette over! You're set to go again in seconds! Preload several cassettes and you can shoot roll after roll of action!

No winding! Four powerful batteries drive the film steadily, silently through the camera. Viewfinder signal tells when it's time to replace batteries.

Zoom smoothly from wide-angle view to telephoto close-up . . . and see the zoom right in the big viewfinder. Electric eye automatically keeps the *f*/1.6 lens adjusted to the light. For special effects, you can lock the lens at any setting, or set the meter for more or less exposure than normal, when desired.

You can shoot at regular 16 frames per second or frame by frame for special titling

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any action!

and animation effects. Built-in filter lets you use the same roll of KODACHROME II Film, Type A, indoors and outdoors.

Be ready for any action. See the fast-shooting new KODAK Electric 8 Zoom Camera soon at your Kodak dealer's. With pistol grip, hand strap, shoulder strap, and one cassette, less than $150. Batteries extra.

For brilliant color, sharp detail, load with KODACHROME II Film! And for convenient direct-mail processing of your films, use KODAK Prepaid Processing Mailers. Available at your Kodak dealer's.

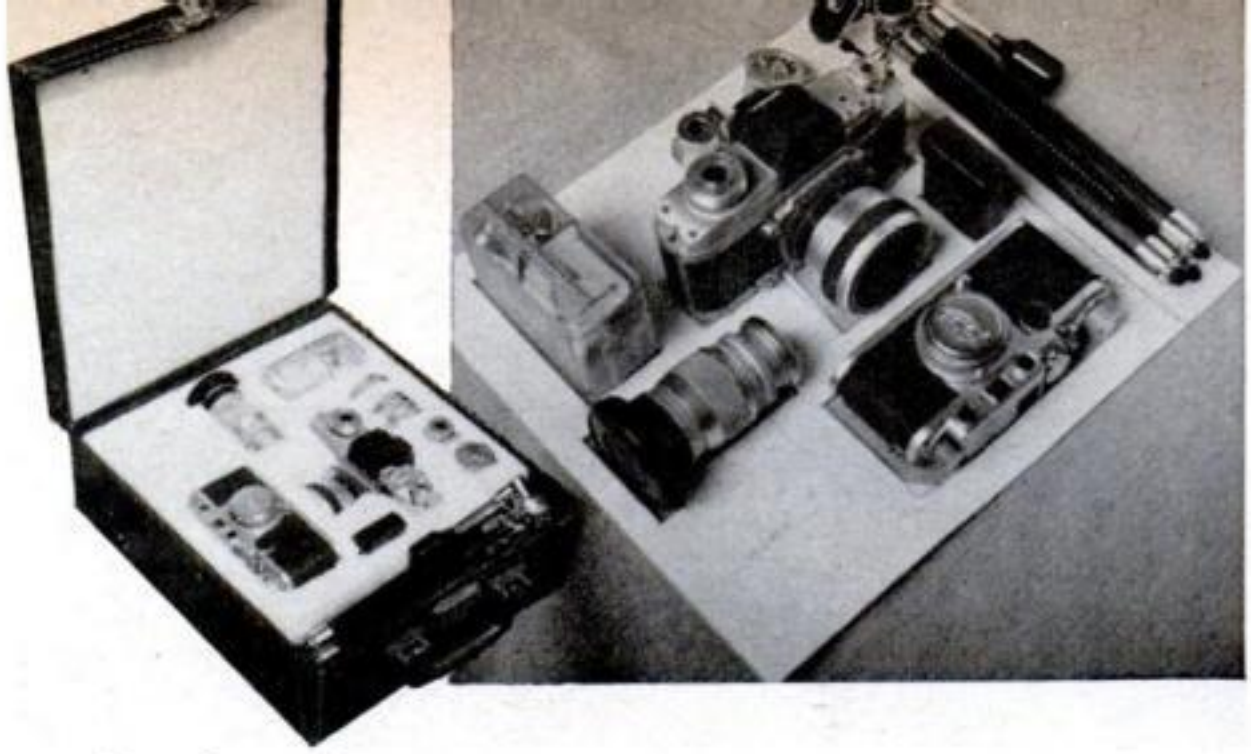
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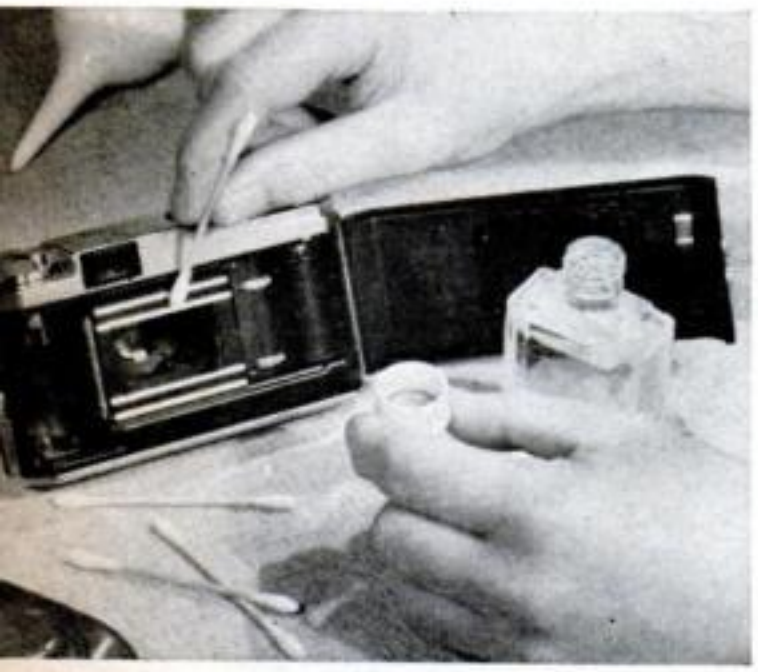
PS PHOTOGRAPHY

Tricks to protect your camera equipment



Shockproof your camera case

An attache case with slabs of protective foam rubber makes a compact, custom-tailored carrier for camera equipment. For a good fit, lay your equipment on a piece of cardboard the size of the case. Allow ¾" between pieces. Snip out a stencil to mark the bottom piece of foam rubber for cutting. The foam rubber in the top, ¾" thick, is not cut out. To determine thickness of the bottom piece, subtract ¾" from space available.—*Ian Evans, Ft. Lauderdale, Fla.*



Swab out your camera

Keeping a camera in good working order calls for an immaculate interior. By using lintfree cotton swabs, such as Q-tips, dipped in acetone (nail-polish remover) you can remove all traces of dust and grit that normally get in.

Keep-cool camera case

Insulated plastic bags that keep foods cold make good camera carriers. A slab of foam insulation on top further insulates the contents. The case is light and inexpensive.—*W. P. Rothschild, Sherman Oaks, Calif.*



Rubber repairs camera top

Unless you keep a camera in its case, the covering soon becomes scuffed. To repair, use plastic rubber. Wipe a thin coat over scuffed spots and dry. To fill small areas, apply dabs of plastic to dimple the surface.—*Ken Murray, Colon, Mich.*

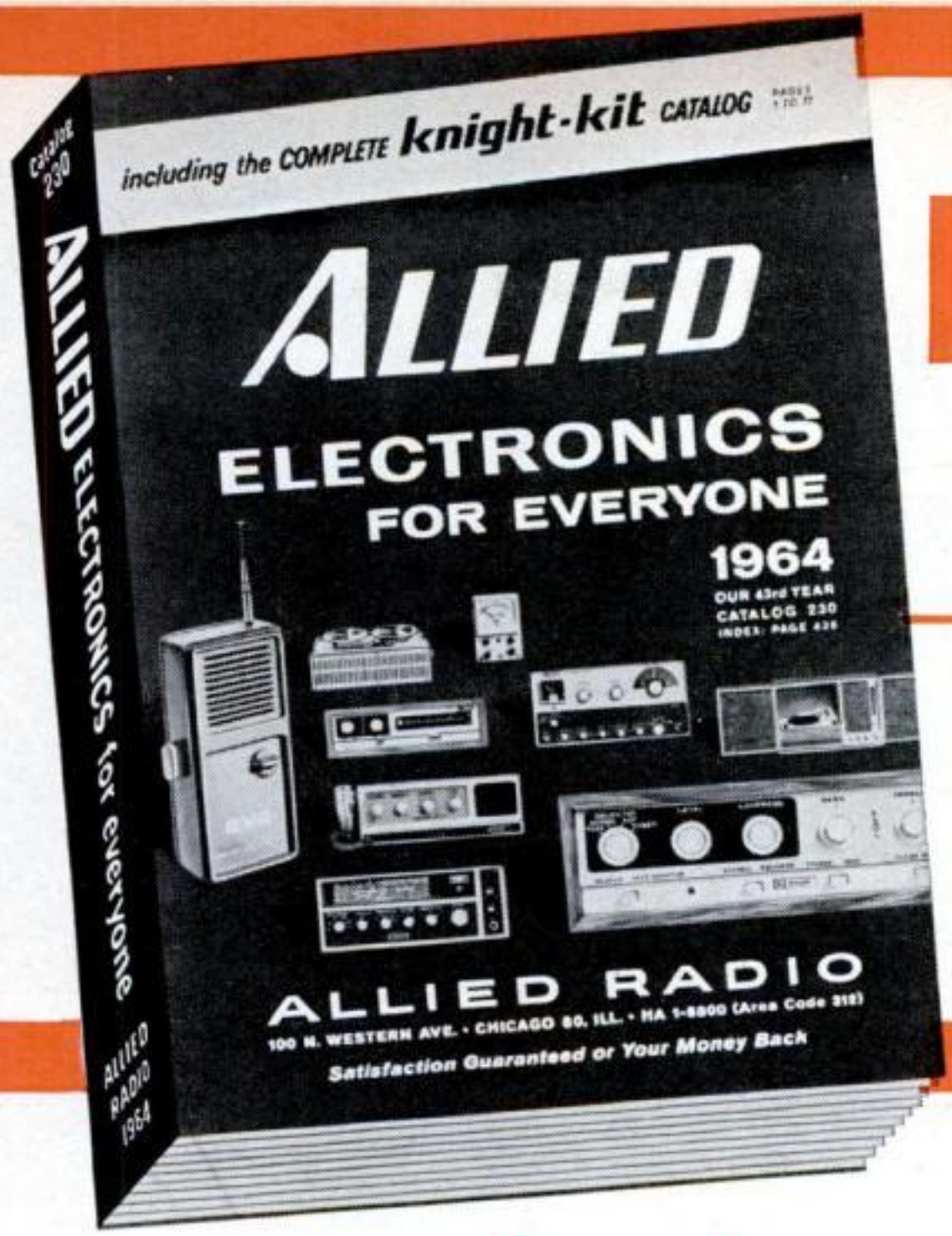




Silicone is dustfree lube for tripod

A turn too tight when locking tripod legs makes them all but impossible to unlock unless they're lubricated regularly. Silicone spray will keep the legs easy to adjust and does not attract and hold dust as oil and grease do. It takes only seconds to back off the lock nuts and spray the threads. If there's a twist lock on the tripod, loosen the legs and work them in and out while spraying on the silicone.—*Herbert R. Pfister, Glen Head, N.Y.*

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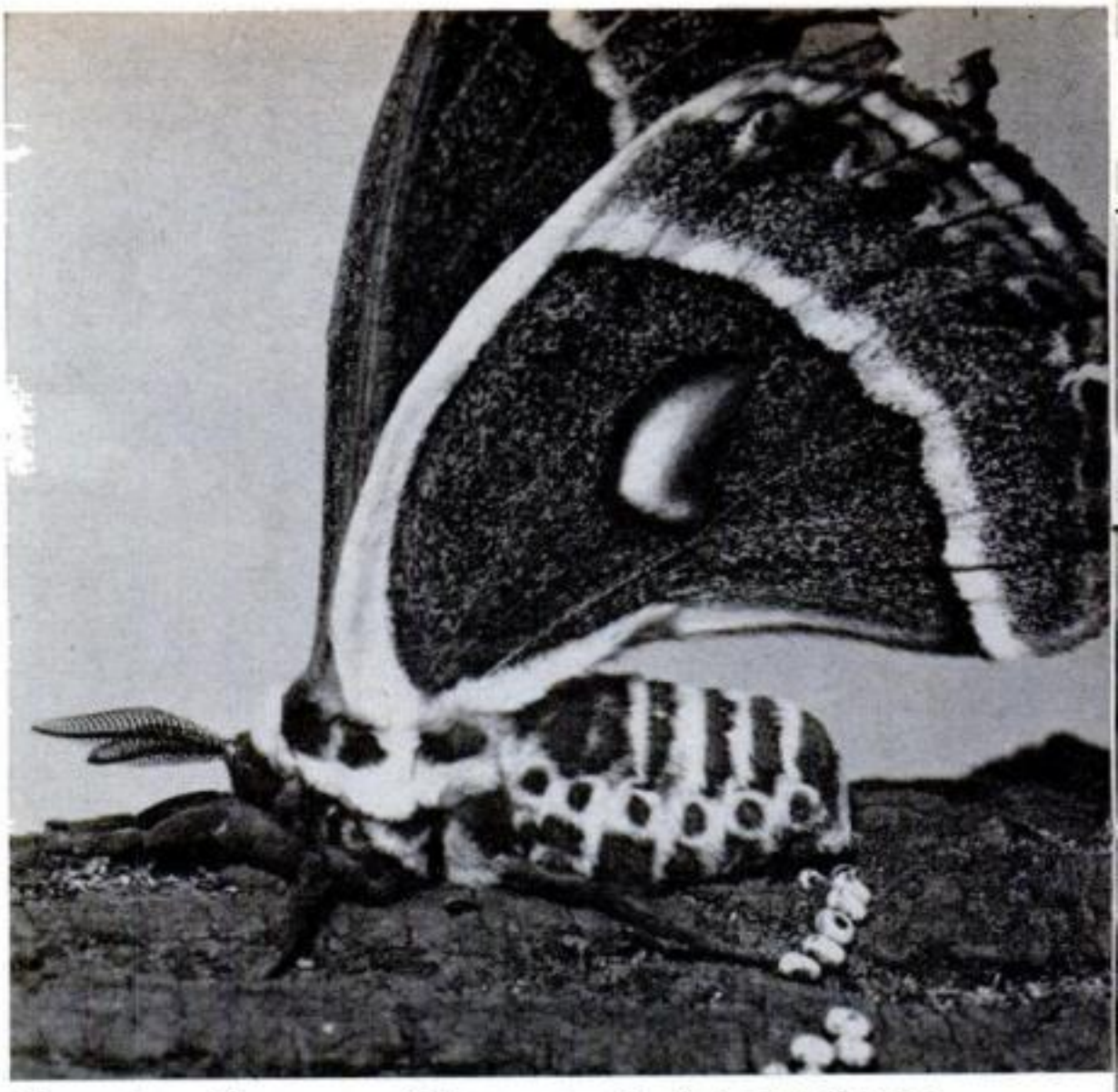
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PS PHOTOGRAPHY

Focusing on Nature

Here's how one photographer records outdoor life on film

By H. F. Brevoort
as told to Bob Hering



Cecropia moth was caught by camera laying eggs (lower right in photo) on a small log—part of its natural environment placed in the screened photographic cage.

I ENJOY the outdoors and I've found that photographing nature sharpens my appreciation of what I see. But when I go to the woods I don't want to be loaded with equipment—it's pared down to the minimum.

I carry two single-lens reflexes, a small electronic-flash unit, bellows, lenses, and a tripod.

I load Kodachrome II in one camera, Plus X in the other. By carrying two cameras of the same make, I can interchange lenses. I use several: from 35mm to 300mm. I always keep a short-focal-length lens on my bellows. If I want to switch from normal to close-up photography, I merely remove the camera lens and put on the bellows with its attached lens.

For lighting, I carry a small electronic flash gun with a gooseneck arrangement I made to attach to my camera. It gives portability and enough light to stop way down—insuring maximum depth of field yet freezing all action. I can move right up to within half an inch of a subject. The electronic flash is useful for general photography as well as nature photography.

I've occasionally used one of the newer ring lights. But close to a subject, a ring light often gets in the way, and it usually gives flat lighting. While this type of lighting is often desirable for color work, I generally prefer a light detached from the camera.



Brevoort's favorite for nature shots is the 35mm single-lens reflex. His electronic flash head, mounted on an inexpensive gooseneck arrangement, permits moving flash in any direction.

I always throw a couple of homemade reflectors into my car—crinkled aluminum foil taped to a 16″-by-20″ mount. The beauty of using a reflector is that it substitutes for two or more lights. If you have only one electronic flash and want to sidelight a subject, or add light from another source, you can use a reflector for balanced lighting.

Backlighting and sidelighting bring out the texture of a pussy-willow cat-

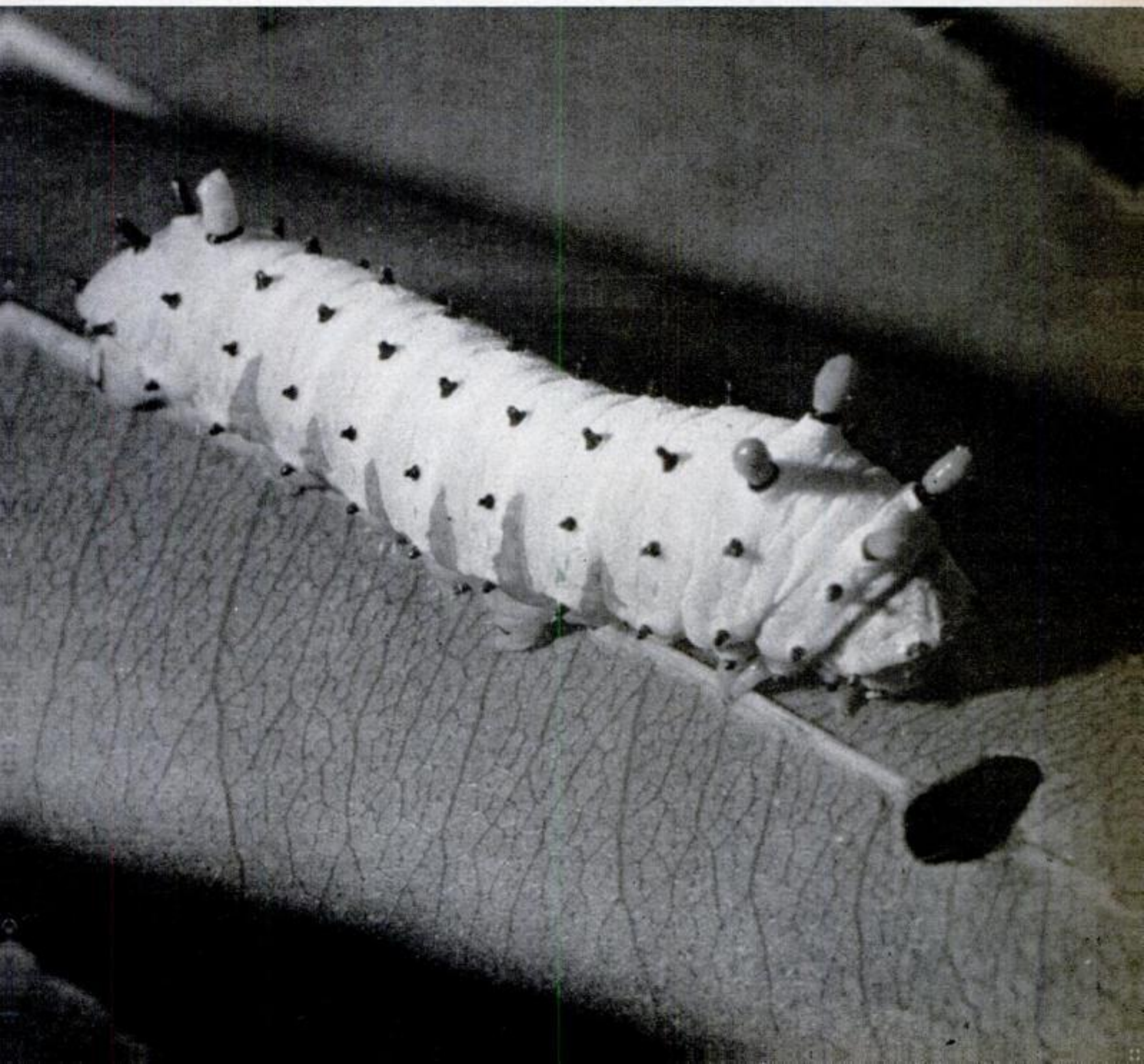
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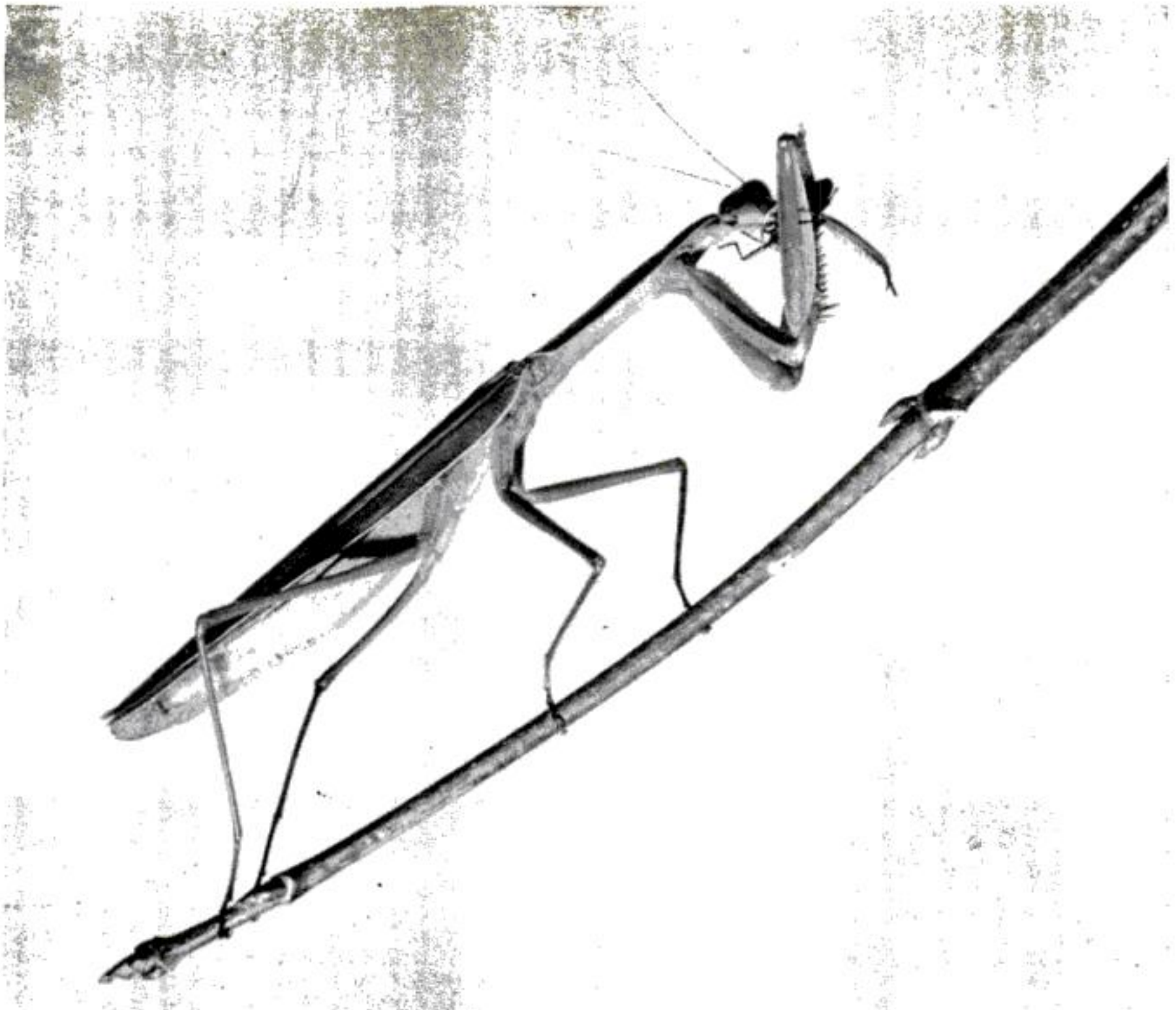
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Intrepid woodcock was most cooperative, letting the photographer approach within 18 inches and set up two electronic-flash units. Because they blend with background, such birds are hard to see. The nest was found in moist bottom land.



Hatched in captivity, the larva feeding on a wild-cherry leaf below is the latest in its line from a cocoon gathered in the fall and kept in a screened cage. The next summer, an adult promethea moth emerged to lay its eggs and produce this result.





Praying mantis—not at devotions, but lunching on a bug—was photographed by electronic flash.

kin and the translucent beauty of the last rose of summer.

The dew on the rose. If a flower is about an inch in diameter, you can shoot it with one extension tube on a single-lens reflex and practically fill the transparency. The normal lens on most 35mm cameras is about 50mm, and that means you've got to get up very close if you're using the lens on an extension tube or bellows. If you want a picture of a flower with a butterfly on it, a 135mm lens on an extension tube or bellows will keep you from scaring off the insect: You can move back and still record a large image.

A feeder is a good spot to watch for birds. You can get some good shots if you have the feeding station in sunlight, place your camera in close, and attach a remote firing device.

The best places to photograph animals are salt licks—natural ones or ones you set up with a block of salt—and water holes. I've caught all sorts of animals—deer, fox, and raccoon, to name a few—at such spots.

Since many wild animals are often out in the early morning or early evening, you'll need flash for supplemental lighting. It's best to use a regular flash instead of electronic flash because the batteries must often be used for several hours. This would quickly exhaust those in a small electronic gun, if you kept the juice turned on.

The deer stalker. Scout the paths and trails animals use. Set up your camera and lights, camouflage them, and focus beforehand. Then shoot by remote control from a downwind blind.

The best way I've found to take pictures of insects is to capture them in the field and bring them home. Then you can control your tiny models and the backgrounds.

A butterfly net is best for catching most

[*Continued on page 159*]

PHOTOGRAPHICALLY SPEAKING

By Bob Hering PS PHOTO EDITOR



Photographers search out pictures of Americana

Photographic teams are roaming the continent gathering pictures for exhibit on Eastman Kodak's "Tower of Photography" now rising on the site of the 1964-65 New York World's Fair. Five color prints, the largest ever made (2,000 square feet), will cover the 80-foot tower. These will be changed frequently during the two April-October seasons, and will depict scenery, people at work and play, pets, and events that are part of living America.

The two- and three-man teams are traveling by car and trailer, shooting pictures on 8″-by-10″ Ektacolor film. Plans are to cover virtually all of the states and much of Canada and Mexico—so don't be surprised if you see them in your area.

Movie competition open to teen-agers

Entrants 12 to 19 can compete for cash prizes in an 8mm and 16mm movie contest sponsored by the University Film Producers Association and Eastman Kodak. There are two categories: one for the 12-to-15 age group; another for those 16 to 19. Color or black-and-white, sound or silent movies can be entered. Films will be judged for originality, story content, and camera technique. For an official entry form, write to: Contest Editor, Kodak Movie News, Eastman Kodak Co., Rochester 4, N.Y. Entries must be postmarked no later than Sept. 10.

Interested in checking your lenses?

There's a 27-page booklet crammed with information on how to check the quality of photographic lenses. It's the National Bureau of Standards Circular 533 (Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.; $1.75). It includes two test charts, one high- and one low-contrast, each with six identical test patterns.

It's useful for testing and rating not only photographic lenses you own or plan to buy, but also such optical equipment as telescopes, binoculars, goggle and sunglass lenses.

A sharp, crisp image is indispensable for modern 35mm camera lenses, especially when you want big prints—8″-by-10″ and up—from small negatives. The test you'll use most frequently is checking lens definition to determine how much you can enlarge your negatives.

Take care of your vacation pictures

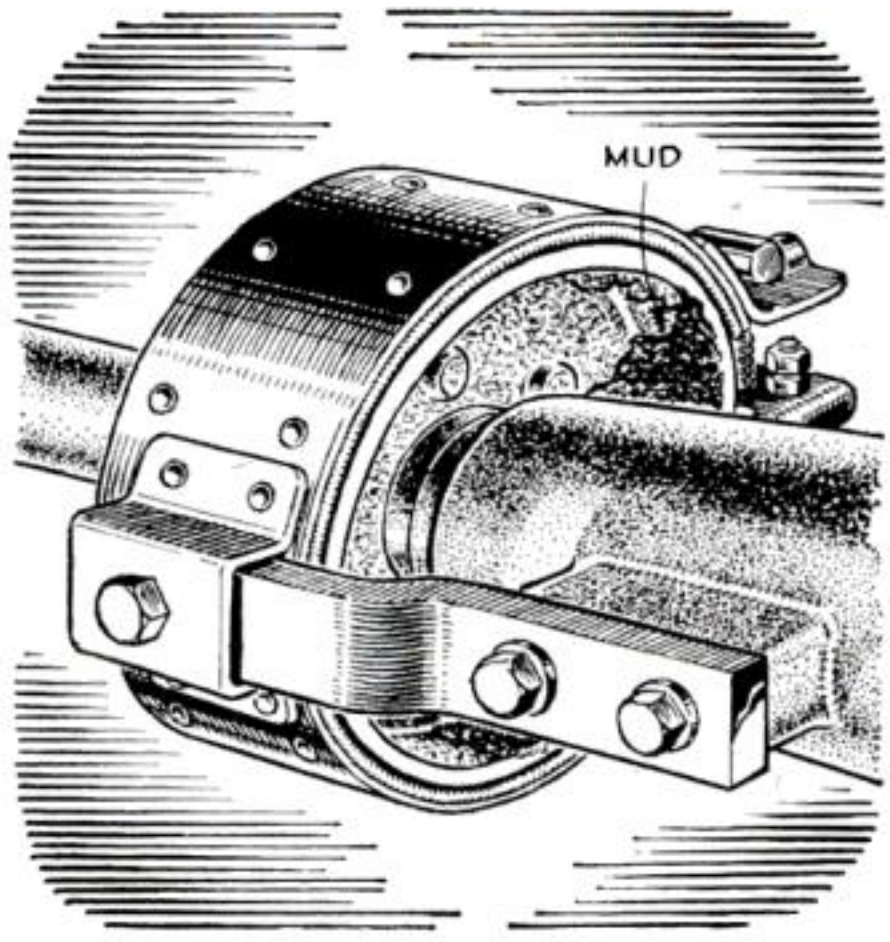
In hot weather, keep film out of the glove compartment and other hot corners of your car. A good spot to store it is on the floor just behind the front seat, out of the sun, and on the side opposite the muffler. An insulated lunch box or ice-cream bag gives good protection. Or carry several prepaid processing envelopes. Then you can mail each roll as soon as it's exposed. Usually, loss of quality is more the result of poor storage after the film has been exposed than before.

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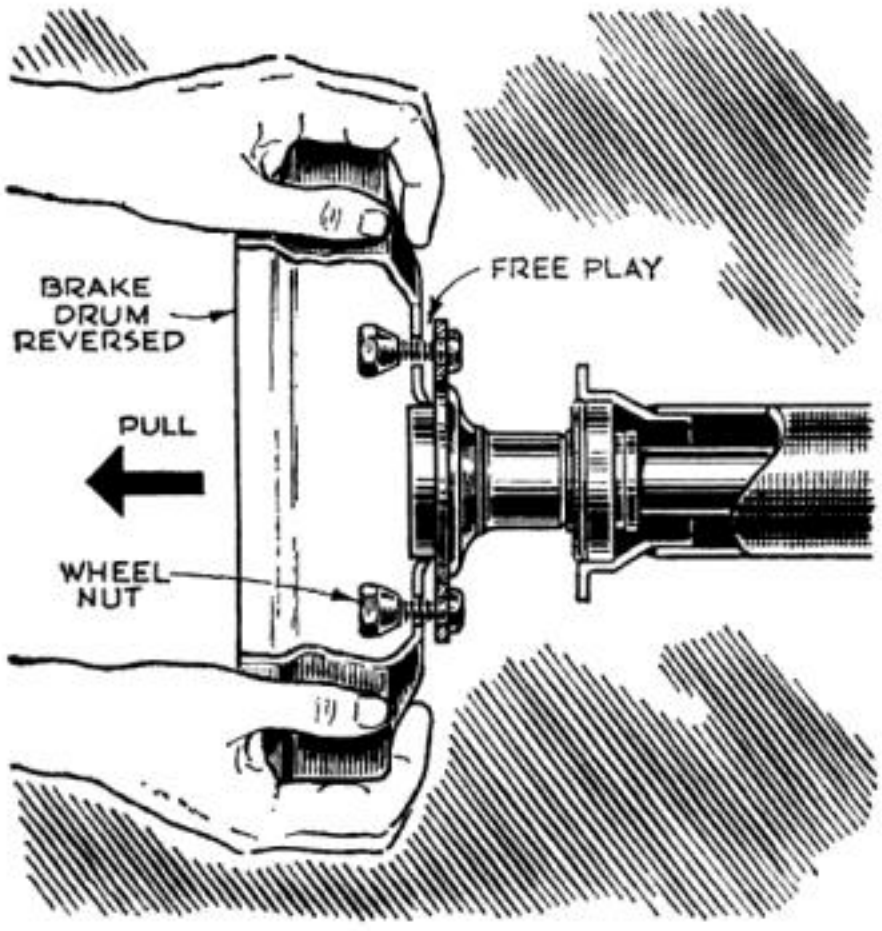


Hints from the Model Garage

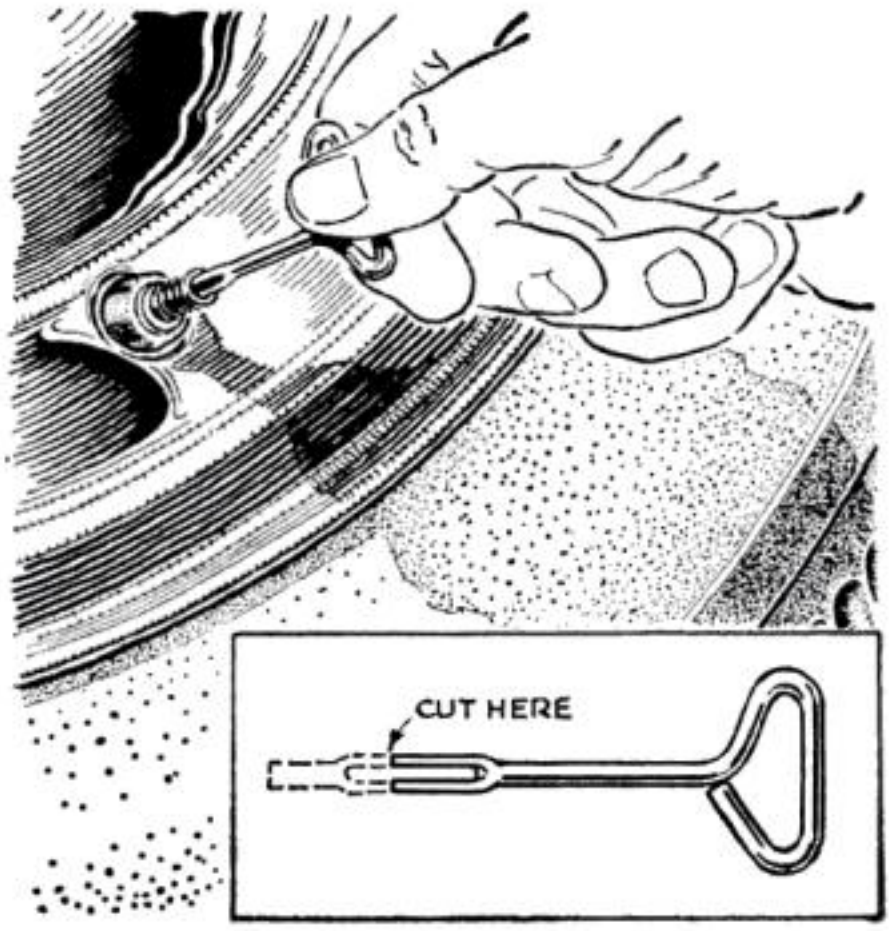
You can check an oil-change sticker from the driver's seat—when you're most likely to think of it—if you paste it on the back of your sun visor. In its usual mounting place on the door frame, the sticker does a poorer job of reminding you to change oil.



Drive-line vibration in recent standard-shift Chrysler Corp. cars with an emergency brake on the drive shaft may be caused simply by an accumulation of dirt on the brake drum. This creates an unbalanced condition. Solution: Clean the drum.



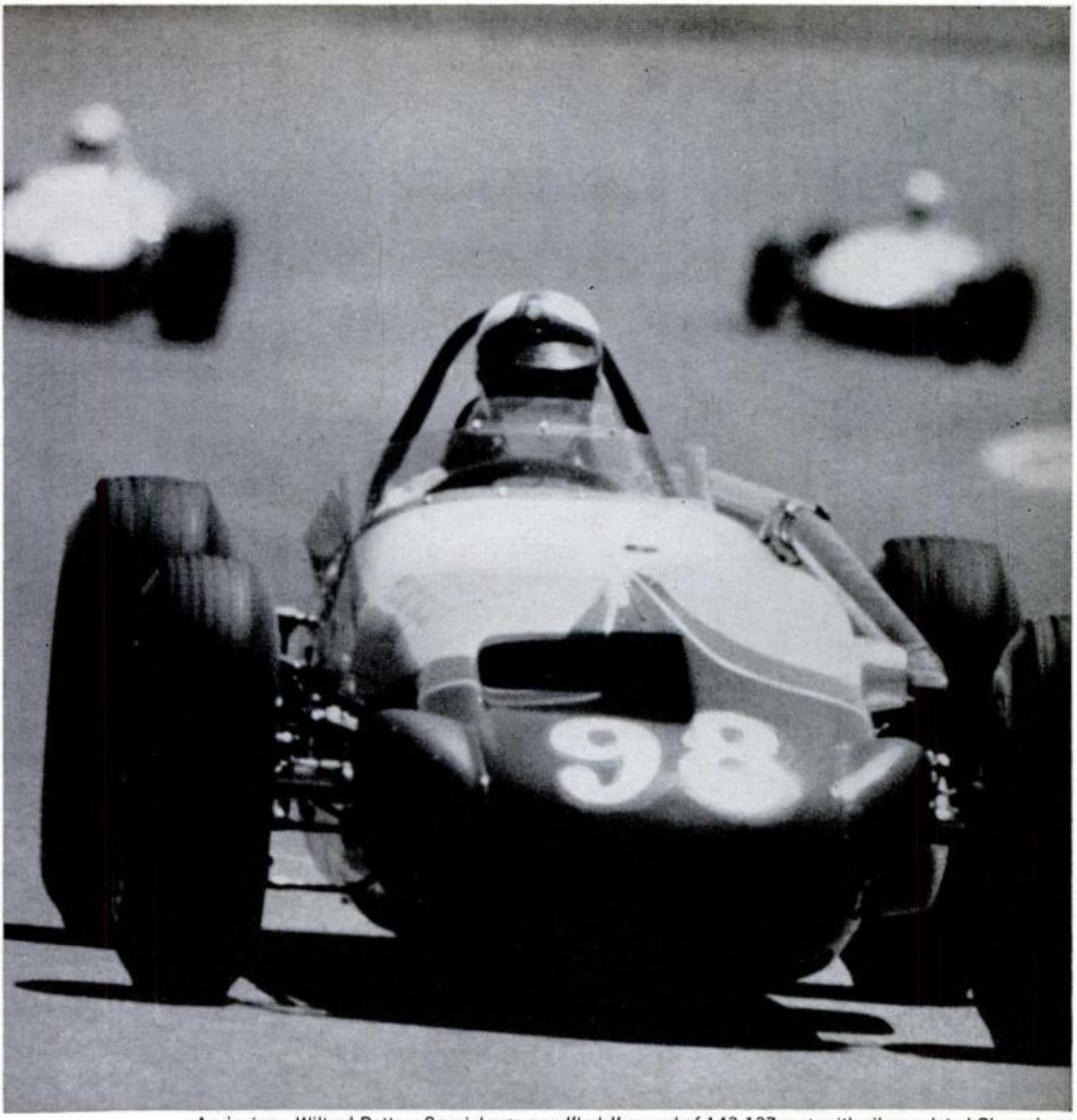
Pulling a wheel to inspect the bearing is difficult without a special puller, unless you try this trick: Reverse the brake drum, place it on the studs, and screw three nuts on part way, leaving about ½" of play. Grasp drum on both sides and jerk it back.



Make your own tire valve-stem wrench from one of the small key openers supplied with many coffee and sardine cans. Cut off the end of the key with a hacksaw or heavy shears and, if necessary, dress the edges of the metal with a file.

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Agajanian—Willard Battery Special sets new "Indy" record of 143.137 mph with silvery-plated Champions

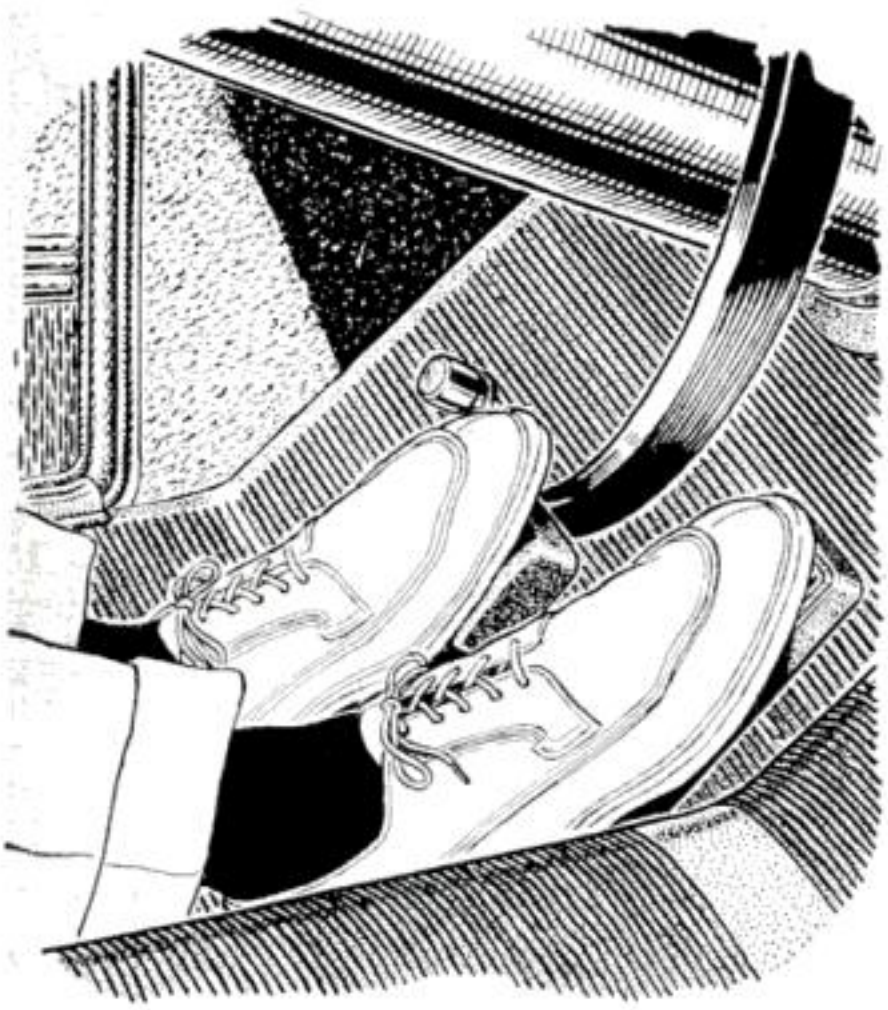
Parnelli Jones wins Indianapolis "500" with Champion Spark Plugs! Men who live power and performance insist on Champions. Why settle for less in your car?



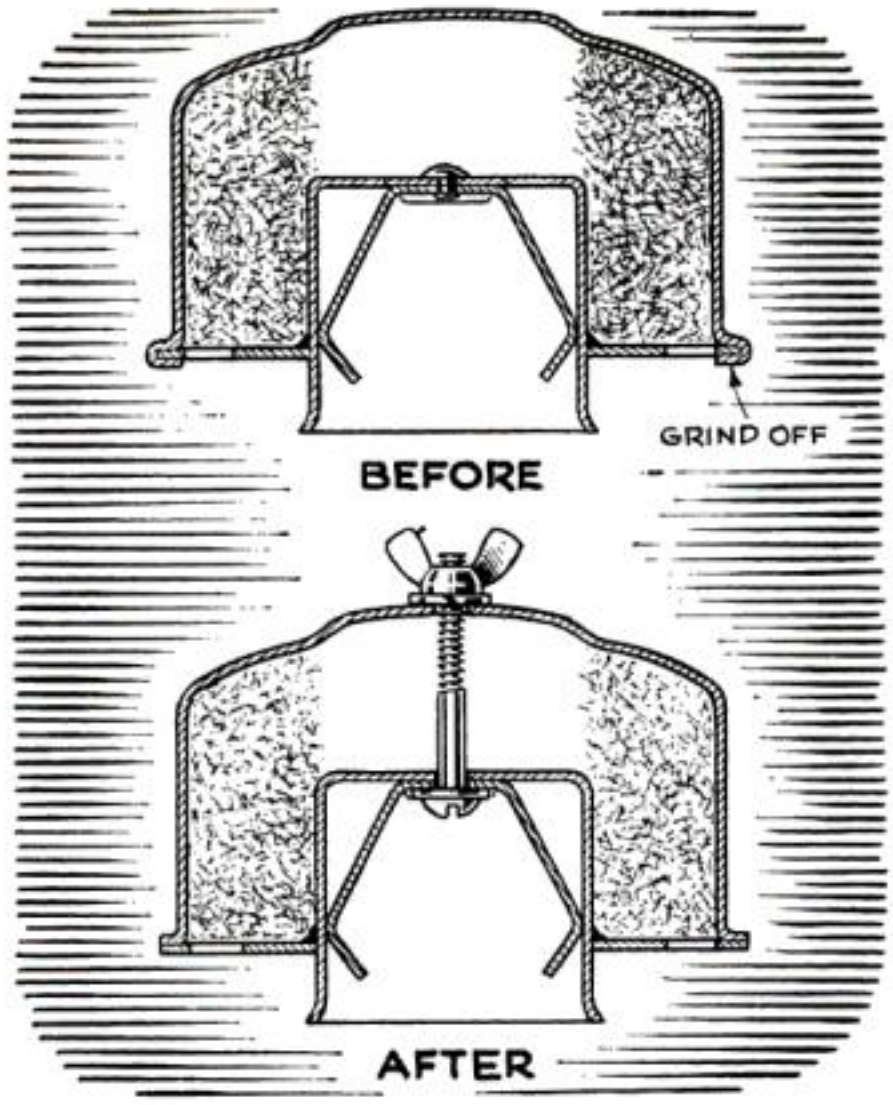
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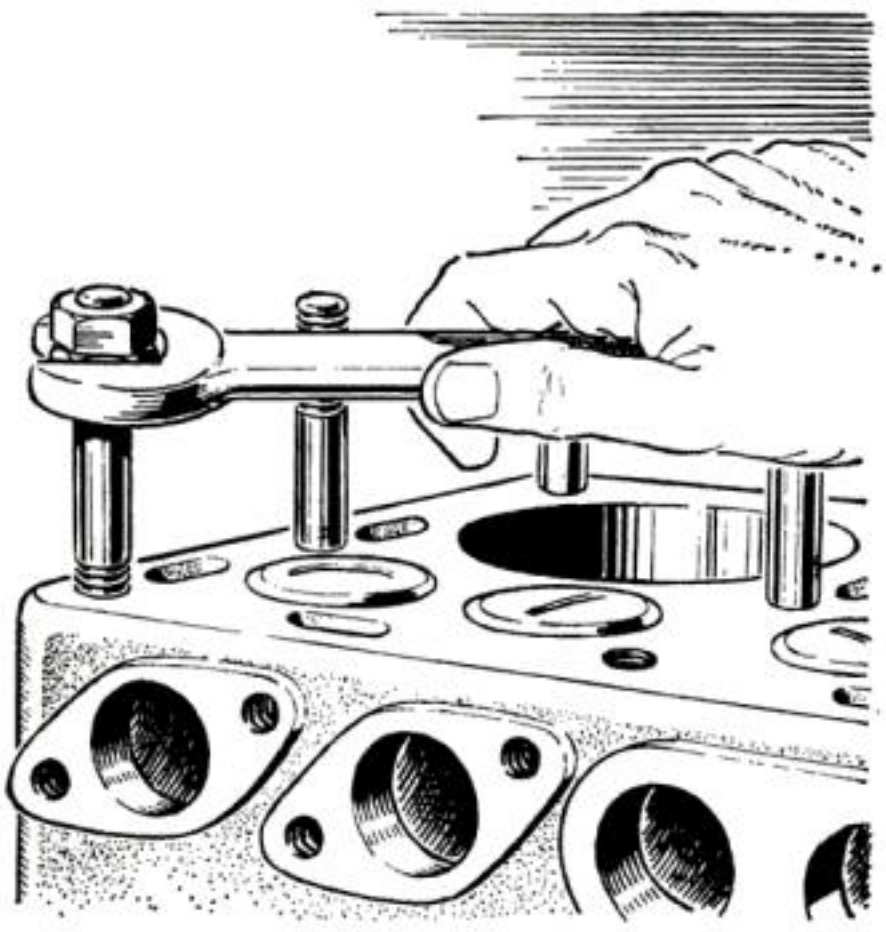
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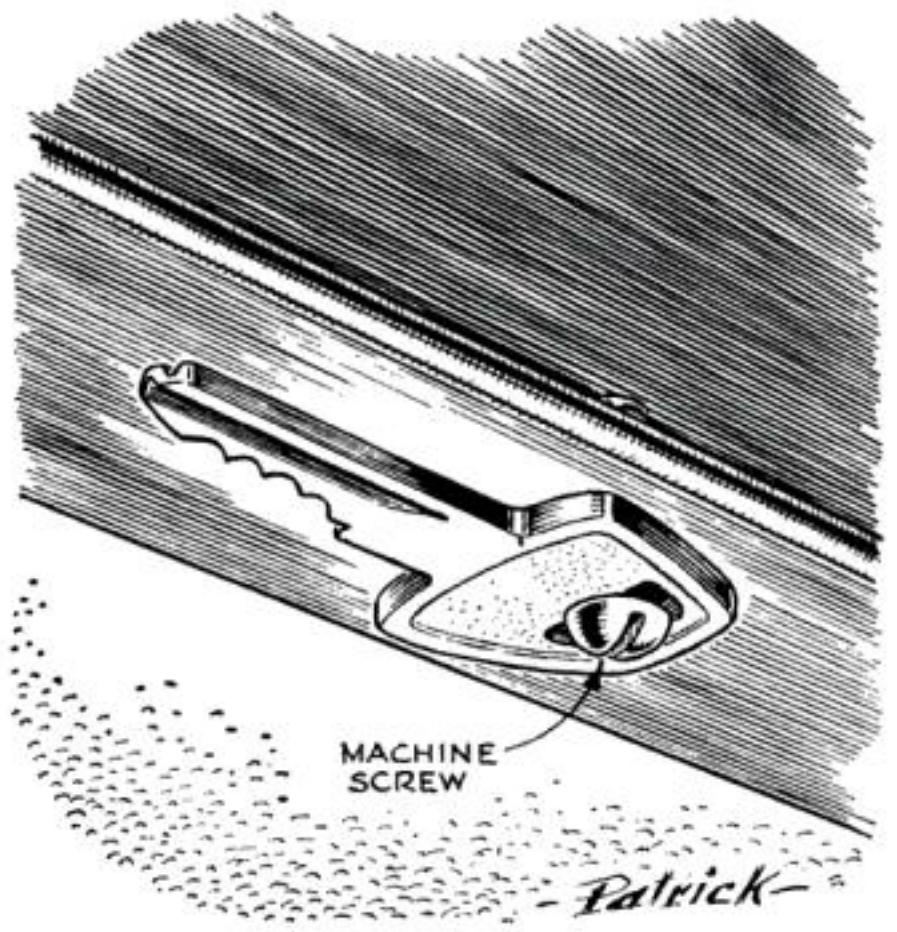
Keep brakes dry when driving through large puddles by lightly touching the brake pedal with your left foot and stepping on the gas with your right. This will hold brake linings against the drums, keeping water out and preventing fade or grabbing.



It's easier to clean the oil-breather cap on some cars if you grind away the rolled edge, drill a hole through the top of the cap, and insert a long bolt, lock washer, and wingnut. A dirty filter can be replaced with ordinary stainless-steel wool.

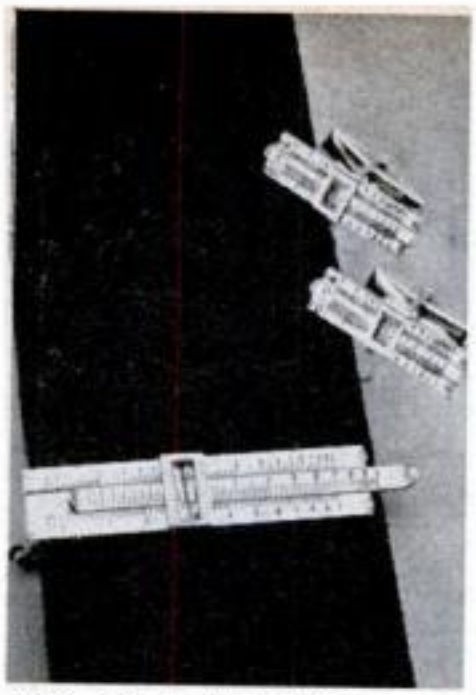


To remove a stud without stripping the thread, screw on a pair of nuts. Using two wrenches, jam the bottom nut against the top one. Additional pressure on the bottom nut will unscrew the stud. It's a simple matter to remove the nuts afterward.



You won't get locked out of your car if you have a spare key. Find a spot to hide the key—under the gas-cap shield, under the hood, inside a fender—and drill and tap a hole. Attach the key with a machine screw. Use a dime to unscrew the key when needed.

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#86 – Want Crisp Fried Foods Without Grease Or Fat? Here's an amazing, specially-designed bacon grill that allows grease to drain off into 4 side wells! Bacon cooks faster, with less shrinkage, and without turning. Use it for sausages, hamburgers, fish patties, too—made of easy-clean aluminum, 8¾"x9½", it's a must for camping gear, picnics, home barbecues! Add 35¢ postage. $2.20



#88 – Come'n Get It Dinner Bell rings out loud and clear! Attach it easily by novel horseshoe support to a tree at your campsite—on the porch or patio—even inside the house. Sound travels far to fit all situations . . . bring kids and campers a-runnin'! An attention getter, a decoration item, and sure to provoke praise! Add 50¢ postage. $5.60

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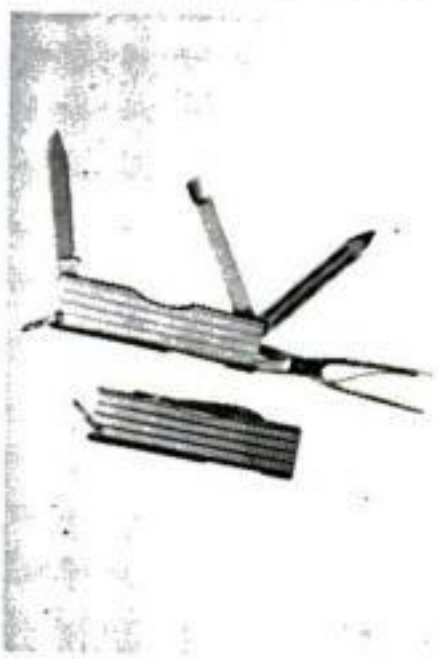
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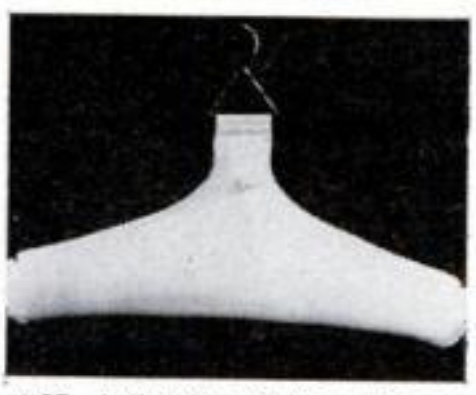
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Gus Gets a Tip from TV

By Martin Bunn

"AN OLD friend to see you, Gus," said Stan, peering around the office door of the Model Garage.

Stifling a yawn, Gus shoved his ledger aside and went out to the shop. Seeing the pinched, sour face of the man waiting in the '59 Buick there, Gus scowled. Stan, Gus's helper, hastily lost himself under a car hood.

"Hello, Silas," said Gus without enthusiasm. "How's your bargain car doing?"

"Nothin' wrong with it!" retorted Silas Barnstable, the stingiest man in town and easily Gus's worst customer. "I'm here to make you a deal."

Gus sighed inwardly. "What kind?"

"Remember them agency fellers that kept filling the differential too full, so it leaked on my garage floor? Well, a month ago I found where it was comin' out. Stopped it, too, by dab!"

"Well, bully for you," returned Gus.

"No call to get sassy," said Barnstable indignantly. Then he turned on what he thought was an ingratiating smile. "Been wanting to check the grease again, but I get cricks crawling under. Thought maybe I could put the car on your rack a couple of minutes. Now, here's the deal. If it needs grease, I'll buy it from you. Hold on—" Silas hastened on as Gus opened his mouth. "It won't cost you nothin', and I already done you a favor."

"I was going to say okay, since the rack isn't in use," Gus replied. "But if you did me a favor, I'd better check it out."

Barnstable's Adam's apple joggled. "Tryin' to tell you, ain't I? Went out to look at some prop'ty this mornin' and stopped for

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The plug struck Silas and was followed by black grease.

some stuff at the Route 9 shoppin' center on the way back. There was this furrin-looking car coughin' and bangin' in the parking lot, so I asked the driver if he wanted a tow cheap, bein' as how I was right there anyway.

"The young feller talked kinda funny, like maybe he was a furriner, too. He said he had some spare plugs he'd try. Time's money, so I didn't wait. But I told him if it don't run right to come here, 'cause you wouldn't charge him no worse'n most garages, and 'd do a lot better job."

"Thanks a lot," said Gus dryly. "Okay. Put your car on the rack."

Gus watched the car until it was safely in position, then headed back to his office, yawning. At the door he stopped, struck by a thought that he now realized had been gnawing at him for minutes.

Turning, he saw that Silas was unscrewing the grease plug in the differential housing. Gus ran toward him.

"Hey, Silas! Hold it," he warned. "How did you stop—"

With a small explosive pop, the plug flew from its hole and struck Barnstable on the forehead. A spurt of viscous black grease followed. Silas yelped and sprang back. Under the car hood, Stan had heard Gus's cry. He'd looked up in time to see the whole thing and was overcome by an uncontrollable fit of choking.

Wordlessly Gus handed Silas a rag.

"I'll sue!" Silas spluttered as soon as his face was free of grease. "I'll charge you with malicious mischief and causin' personal injury, Gus Wilson!"

Gus made no answer.

"You knew that would happen!" raged Barnstable. "You yelled, to take my mind off what I was doin' and—"

"I tried to stop you," retorted Gus. He walked under the car and inspected the rear-axle housing. "Come here, Stan. I want you for a witness."

Silas, still fuming, watched with Stan as Gus pointed to a small plug set in at the top of the housing. "That's a pipe plug. But on this car there should be an open vent line here, to release the pressure built up as working parts warm up in operation.

"Because it oozed grease, Silas took off

CONTINUED

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the vent line and screwed in this plug. It bottled up the pressure, probably forced some grease past the bearing seals, and blew up in his face just now. Still want to sue, Silas?"

"A lawyer'd cost me more than I'd get. I'll forget it if you put back that vent thing. I never threw it away. It's in the trunk."

"Maybe it was my fault at that," mused Gus after Silas had driven out.

"Aw, how could it be, Gus?" asked Stan.

"If I'd been wide awake, I'd have caught on as soon as he said he'd stopped that 'leak.' But I watched a late TV movie last night and I'm sleepy."

"Well, I wouldn't bother feeling sorry for pinch-penny Silas," returned Stan. "Nor believe that fairy tale about sending you a customer, either."

The phone rang. Stan answered it and came back looking confused.

"You won't believe it, Gus, but that was a road call from the man Silas gave your name to. The car backfired so hard it blew an exhaust joint. He wants us to come and get him."

"Well, go ahead," said Gus.

"He hung up too soon. I don't know where he's stuck. He said he's near the 'roundabout' off Route 9."

"The traffic circle," explained Gus. "He's at the shopping center, Barnstable said."

Stan returned with a Peugeot in tow. From it stepped a young man with a fair mustache and straw-colored hair.

"Gus Wilson?" he asked as Gus rolled a creeper under the car. "Very decent of you to come to a stranger's help so quickly."

"That's what we're here for," said Gus.

"Name's Neville Sands—exchange student. The car belongs to some American friends. They lent it me to see a bit of your country."

Stan came out from under the car. "I slipped that joint back. No sweat."

Sands looked questioningly at Gus.

"No difficulty about that exhaust joint. What's your engine trouble?"

"There wasn't any, you know, until yesterday. The owner had a new condenser, distributor cap, rotor, and points put in before I started. Last night the motor began to miss. When I stopped for petrol, I had the sparking plugs cleaned, but that did no good.

"This morning an agency mechanic suggested the carburetor was at fault. He cleaned it and installed an overhaul kit. The motor seemed to run better at first, but after a bit it got so bad I had to stop at that car park where your friend met me."

Gus winced where it didn't show. "We'll check for water in the gas, see if the fuel pump's delivering, and go back over the ignition," he said.

"Good show. I bought a new coil from the agency, with the thought that it might be useful. You'll find it in the boot. I'll have a spot of tea meanwhile. Is there a pillar box close by?"

"Turn left when you go out," directed Gus. "At the end of the block."

Stan was busy. He drained a little water from the gas tank, checked fuel-pump delivery and found it good. He opened the distributor. The points were properly gapped and in good condition. With the ignition on, Stan flicked them open by hand while holding the coil lead near the block. A rather thin spark jumped over.

"Could be a bum coil," Stan said to Gus. "Where'd he say we could find that new one?"

"In the trunk."

"Ah yes, the bloomin' boot. And what's this pillar box he's going to for his dish of tea?" asked Stan.

"A mail box," said Gus with a grin. "I'm surprised you don't understand the Queen's English, Stan."

Stan grunted, found the trunk key and installed the new coil. But manual opening

CONTINUED

PS Puzzler



"How much did you say these were?" Hopkins asked the hardware-store owner.

"A quarter each."

"I need 250. Here's a buck."

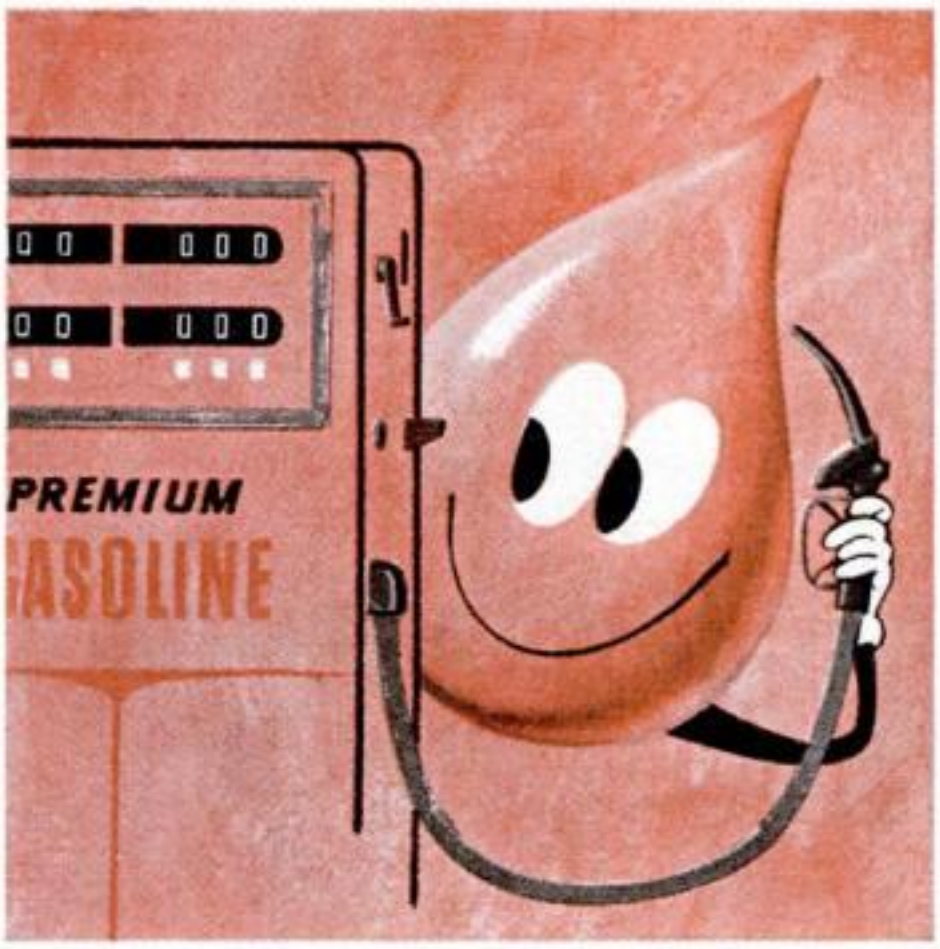
"Okay," said the owner. "Here's your quarter change."

What were they talking about?

Numerals—the kind you put on a door to indicate house number. At 25 cents each, 2, 5, and 0 would cost 75 cents.

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of the points produced no better spark than before; and when he started the engine it still ran very roughly, with occasional back-pops, as if it might be out of time.

"I checked the firing order, and the plug leads aren't mixed up or so close they'd be crossfiring," Stan said as Gus came over to the car. "If he hadn't said that this condenser is brand-new, I'd yank it and try another."

Gus nodded. Suddenly he switched off the droplight Stan was using. "You've hit it—almost. Look at that."

He pointed at the condenser, which was mounted on the outside of the distributor case. Small red sparks flickered around the mounting screw. Gus pressed a screwdriver against it.

Instantly the bucketing engine settled to a rhythmic idle.

"Wizard!" said Sands when he heard the smoothly ticking engine a little later. "Compared to you, those other mechanics were rather clods."

"Only the first one's to blame," said Gus. "He must have lost the metric-thread screw and used a slightly undersized American one. When it loosened, the condenser was ungrounded."

Sands frowned. "Oh, I say, you mean unearthed? Perhaps I'm the clod. Always thought a condenser was merely to keep down static in the wireless. What's it do, really?"

"Other condensers do kill radio interference," said Gus. "But the vital condenser is in the low-tension ignition circuit. When the points close, current flows in the primary winding of the coil and sets up a magnetic field around it. But it's when that field collapses that it induces a high-voltage current in the secondary, which fires the plugs.

"Connected across the points, the condenser acts like a tank or reservoir. When the points open, the primary current rushes into it, letting the magnetic field collapse in milliseconds. That fast drop generates a strong spark. Also, by absorbing the interrupted current, the condenser prevents arcing and lengthens point life."

"And that loose screw cut the condenser out?" asked Sands.

"Yes, intermittently," said Gus. "With no condenser, the primary current tried to jump the points by arcing across them, so the coil's field didn't collapse fast and the spark was weak. Arcing also delayed the break, making the spark so late that it sometimes fired when the rotor had moved to the next cylinder. And that was what caused the backfiring."

"I'm really much obliged," said Sands. "Now if I may settle my account and be on my way . . ."

"How come you caught on to this guy's lingo," asked Stan as he and Gus were closing shop, "when it threw me?"

"Oh, I read an English car magazine now and then," confessed Gus. "Keeps me up to date on foreign cars."

"You never got 'pillar box' that way. For somebody who lost sleep over a late movie, Gus, you were pretty sharp—still hitting on all cylinders."

"You know, old top, even that helped!"

"What? The late show?"

"Uh-huh," Gus said with a grin. "It was an English movie." ■■



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[Continued from page 51]

tion and loss of life were caused by the 50-foot-high tidal wave that followed. It bore down on the Javanese mainland at four times the speed of a hurricane, on its way hitting the Charles Bal, Northam Castle, and several other vessels at sea.

Miraculously, none was sunk. Captain Watson reported afterwards that his ship was more in danger from the continuing rain of debris than from the huge tidal wave. At times the debris was a foot thick on the vessel's decks.

On land the story was different. The tidal wave hit Batavia 20 minutes after the blast and tore the port to pieces.

It rushed on, and in a matter of minutes more than 300 towns along the coasts of Java, Sumatra, and Borneo were inundated. The wave took six hours to reach Australia, but was still strong enough to hurl small boats ashore and wreck installations on the seafront at Perth. It destroyed 300 river boats at Calcutta, India, nine hours after it had started out, and caused extensive damage at ports along the Japanese seaboard.

By far the most tremendous oceanic disturbance ever recorded, the Krakatoa tidal wave was plainly noticed at Cape Horn, 8,000 miles away, and in the English Channel 11,400 miles away.

In all, more than 5,000 ships and boats were destroyed. Almost every vessel wrecked was moored or anchored close to the shore when struck by the tidal wave.

THE dust from the explosion billowed out over Asia and Europe and on to the north polar regions. British scientists recorded the passage of shock waves no less than seven times.

Clouds of dust hung suspended in the stratosphere for months, causing strange after-effects. All over the world the most beautiful sunsets were witnessed. In Paris, New York, London, and Cairo, the setting sun appeared blue, leaden, green, and copper-colored. At night, the moon and stars appeared green.

But the most intriguing and significant fact about Krakatoa is that nothing remotely like it has occurred on the face of the earth since. And the probability is that nothing comparable happened before—in the span of human life, anyway. To find its equivalent, geologists have to go back eons of time, long before mankind, when the earth was one ball of fire. History remembers the devastations of Vesuvius and Etna, but these, compared with Krakatoa, are like firecrackers beside the hydrogen bomb. The bomb itself is a squeak against the energy released by Krakatoa.

Krakatoa's awesome shroud in the upper atmosphere began to disappear in the spring of 1884, and the final chapter in its history seemed to be over. One-third of the island still remained above the sea's surface, but buried under layers of ash. Plants, insects, and birds—every living thing—had been dissolved in a fiery cloud.

Scientists from many countries converged on the place where Krakatoa had been, but there was nothing much to be seen except the fragments of the island and the layers of dust.

AND then a miracle occurred—the rebirth of life. Four months had passed since the eruption. A botanist poking about in Krakatoa's ashes found an almost microscopic spider optimistically spinning its web where there was no other living creature to be caught by it.

In a few years, as if from nowhere, came grasses and shrubs, worms, ants, bees, beetles, and birds. Clusters of fern were found, together with four varieties of flowers and two of grass. Even the snakes and the scorpions had made their way back, possibly on rafts of driftwood. Lizards, pythons, and crocodiles, came swimming over from nearby islands.

By 1924 Krakatoa was clad again in vegetation, and 400 classified varieties of animal life thrived there.

But deep down in the earth the heaving monster still grumbled. The bottom of the sea began to roll and buckle again, and in 1928 it sent up to the surface a new volcano to sit next to the original Krakatoa. The natives call it Anak Krakatoa—"the Child of Krakatoa."

Before the eruption, Krakatoa was almost the same size as New York City's island of Manhattan. Two-thirds of it was blown completely off the map.

According to the scientists, Anak Krakatoa may suffer its predecessor's fate. The huge volcanic fault on the sea bed is only temporarily sealed. It may challenge the ocean at any time with the force of a thousand H-bombs. ■■

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SHOP TALK

By Sheldon M. Gallager



A brand-new idea in abrasives: files that are flexible



Our European Editor, David Scott, sends us word of an exciting new British-made file that's flexible enough to turn corners. It's a series of tiny, file-toothed metal slivers bonded to a cloth backing. Result: an abrasive that has the cutting ability of a file and the flexibility of sandpaper. It can be used in a variety of ways, either freehand or in power sanders, as shown at left. So far, it's available in flat sheets, but belts and disks are on the way.

We tried several test samples and found the abrasive working best at high speed. Cemented to a 3″ sanding drum, it quickly shapes contours in soft metals such as aluminum and brass. Used freehand, it does a fine job in smoothing rough castings and welds. At present, it comes in three grades: coarse, medium, and fine. The medium grade is approximately equal to a 60-grit carborundum wheel.

Flexifile, as the new abrasive is called, is expected to find its way into U.S. hardware stores soon. Meanwhile, it can be obtained by mail from its British maker. Anyone interested should write for details to Davis & Worth, South Close, St. Brelade, Jersey, C.I., England.



Two neat accessories for a propane torch

The BernzOmatic people have a couple of unusual accessories for their popular propane torch that you may not have seen because they aren't common hardware-store items. One is a handy pistol-grip extension burner that's connected to the gas tank by a 4′ flexible hose, as at left. This way, you don't have to hold the tank itself while you're soldering. The tank can be hung from a tool-board hook or clipped to your belt for portable use. There's also a hanger on the tank for the burner so you don't have to lay a hot nozzle down on the bench.

The other accessory is a metal stand that clamps to the base of any BernzOmatic torch to hold it safely upright on a bench. The extension burner sells for about $13, the stand for $1.25. They're available through BernzOmatic dealers, though you probably won't see them on the shelves. Both are slick ideas, we think, that more people should know about.

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How to Get Started in Scuba Diving

[Continued from page 94]

can paddle on the surface with your face down in the water. See something interesting? Then dive down for a brief gander or even take a pot shot at a fish with your spear gun. (Spear-fishing, by the way, is done *only* with skin-diving gear; it's considered unsporting to spear-fish when you're using scuba equipment.)

Your chances of getting into trouble with skin-diving equipment are small. There are no pressure problems, not too much chance of getting trapped in underwater caves, and almost no equipment to get out of whack.

In scuba diving, you carry an artificial lung on your back (scuba is a made-up word standing for *s*elf *c*ontained *u*nderwater *b*reathing *a*pparatus), and you *can* get into trouble. An unskilled diver can come up too fast and forget to exhale while he's rising, doing physical damage to himself. Improperly maintained equipment can malfunction.

To be safe, you need to be pretty handy in the water. Championship stuff is not required, but you should be able to swim 300 yards on the water and 15 yards below without flippers, and stay afloat without accessories for at least 15 minutes. And, of course, you should be in good physical shape, without any ear or sinus problems that would keep your internal head passages from adjusting to changing water pressure. (A check by your doctor is a first-rate idea.)

These qualifications should take care of you. To double the safety factor, scuba divers *always* use the buddy system; no intelligent scuba man ever dives alone. If you get into trouble, your buddy is there to get you out.

How deep can you go? At shallow depths (up to 33 feet), there is no decompression problem, and you can go down and come up at will, exhaling or breathing normally on ascent. Beyond that, you have to keep check of your time and depth, so you will know exactly where to stop for decompression, if necessary. This is no problem if you use a depth gauge, a watch, and a decompression chart. An experienced diver can go down to 125 feet with ease.

How long will your air last? The standard 71.2-cu.-ft. tank will give you about 80 minutes in shallow water. The deeper you go or the colder the water, the less time you have: The air in your lungs is more compressed, and you use up your supply

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faster. You can extend your time by wearing two or even three tanks. For short dives (and a lighter load on land) you can use a small tank: usually 42 cu. ft.

Is scuba diving hard to learn? Not if you meet the swimming requirements and are willing to study the techniques with the same seriousness you'd give to anything you wanted to do expertly. And this is one sport you *must* do expertly, and in which you *must* receive instruction. (Abercrombie and Fitch, New York's famous sporting-goods store, refused a $500 order for scuba gear from a wealthy yacht owner who announced to the salesman that he had no intention of taking any instruction in how to use it. "That's one life we don't have on our conscience," Earl R. Seaman, head of Abercrombie's scuba department, told me.)

Instruction is available in YMCAs across the country or from private instructors. But make sure that your instructor is certified by the YMCA or the National Association of Underwater Instructors (NAUI). There are also private schools. The school where I received my instruction charges $30 for a 16-hour course—about average. And there are scuba clubs (more than 1,100) throughout the country where you can get advice and perhaps instruction.

Books are only a supplement to learning scuba, but they'll help you understand the theory. The following are recommended: *The New Science of Skin and Scuba Diving* (Association Press, NYC, $3.95); *Underwater Education*, by Albert A. Tillman (William C. Brown Co., Dubuque, Iowa, $3.50); and the U.S. Navy's *Diving Manual* (U.S. Govt. Printing Office, Washington 25, D.C., $3.25).

Now to the equipment you'll need, what it does, and what it costs. Here are the basics for skin diving:

Face mask. This helps you see underwater, keeps the water out of your eyes, and in many models lets you pinch your nose closed to help you equalize with the water pressure. Cost: $3-$15.

Snorkel. With this J-shaped pipe, you can breathe surface air while your face is underwater. Cost: $2-$4.

Fins. Also called flippers, these rubber frog feet give you more power with less effort. Cost: $6-$14.

Flotation. For emergency (cramp, fatigue, etc.), every diver must have a device that will keep him afloat. These come in vest

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(Mae West) or tube types and are inflated by replaceable CO_2 cartridges. Cost: $8-$20.

Diver's flag. A red-orange rectangle with a diagonal white stripe, the diver's flag warns boats away. Cost: $1-$10.

Knife. Sheathed against the diver's leg, the knife is ready to cut him out of trouble (fishing lines, kelp, nets, etc.). Cost: $4-$10.

Spear gun. Generally powered by heavy rubber bands, although CO_2 and compressed-air models are around, they give the undersea hunter a range of from 6 to a claimed 30 feet. Most good hunters, though, won't shoot until the fish is almost at the end of the gun. The spear point has a barb (or barbs) that opens up in the fish like the wings of a Molly screw. (It can open in humans, too, which is why you always load and unload underwater.) As the end of the spear passes out of the gun, it catches a collar and pulls out the line. Cost: $10-$80.

With the exception of the spear gun, all the equipment listed above is usable for scuba. For scuba, in addition, you need:

Tank block. Tanks generally come in 71.2-cu.-ft. and 42-cu.-ft. sizes (with 18s, 38s, and 50s available), and are of steel, sometimes lined with plastic. Imported tanks are banned by federal law. Every tank has its own registration number, and the law requires that it be tested every five years (compressed-air people are forbidden to fill it if the approval date isn't right). They are rated at 2,250 p.s.i. A complete tank assembly—tank, control valve to turn the air on and off, and carrying harness—is called a "tank block," and it's a handy way to buy. You know that everything will fit. Valves come in two major types: "K" and "reserve." The K valve is a simple on-off type. The reserve valve has another, and valuable, feature: It signals when your air is getting low (at 300 p.s.i. for a single tank —enough to get you to the surface without trouble) by restricting the air flow. Pulling a rod restores normal air flow. Cost: $50-$87.50 for a single tank block; $110-$165 for a double tank block (two tanks linked together). A boot, which enables you to stand the tank block on a flat surface, costs about $4. Filling a tank costs between 50 cents and $1.50.

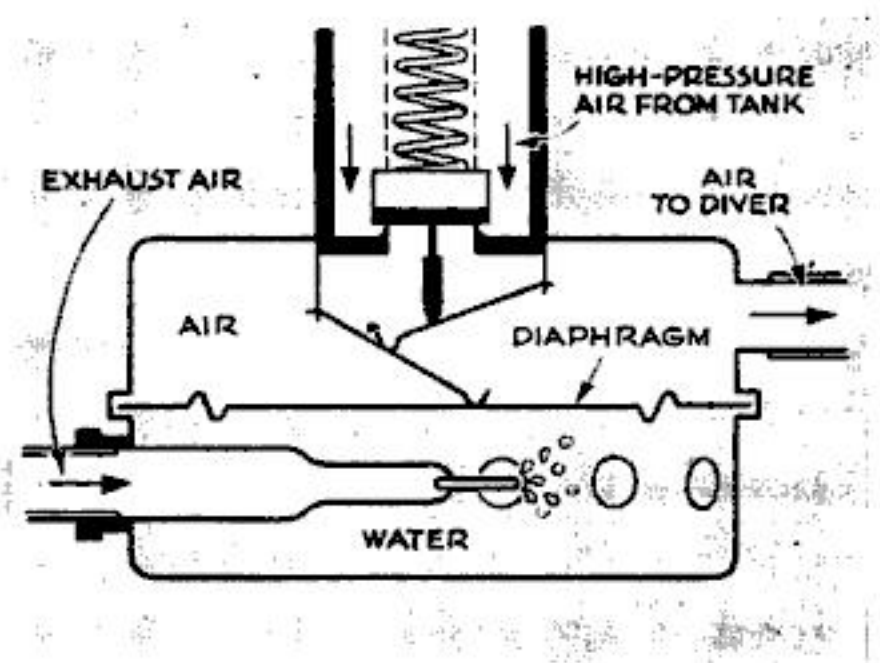
Regulator. All regulators use basically the same mechanism: a chamber in which water pressure pushing against a diaphragm opens an inlet to the air tank, feeding the diver air on demand at the surrounding water pressure. Some regulators add a "stage," dropping the tank pressure twice before it gets to the diver. Advantage: easier breathing at deeper depths when tank pressure is low. You also have a choice between one- and two-hose systems. In the single-hose, two-stage system (the most popular today), the first stage is at the tank, the second in the mouthpiece, permitting an even flow of air regardless of tank position in relation to diver. Only disadvantage of the single-hose system: bubbles rising in front of your face. Photographers prefer a two-hose system where the bubbles rise behind the diver. Cost: $30-$95.

Weight belt. To hold you down underwater (a problem, especially in salt water), most divers need weights. These come in one-, two-, three-, and five-pound sizes at about a dollar a pound (or buy a mold for $3.95 and make your own). Cost of belt alone: $2-$5. With weights: $9-$20.

Depth gauge. Knowing how far down you've gone allows you to figure out decompression stops—a necessity in deep or multiple-tank diving. Cost: $3-$35.

Watch. Duration of stay at any depth is as important as the depth itself. A diver's

CONTINUED



How a regulator works: At heart of regulator is a chamber divided by a diaphragm. As diver inhales, withdrawing air, pressure on air side of diaphragm is lowered, and water pressure on other side pushes against diaphragm. Diaphragm pushes levers that release air from tank valve, and high-pressure air flows into chamber. Pressure is reduced automatically to diver's demand, and air flows through hose to diver. Flow stops when diver stops inhaling and pressure on air side of diaphragm equals water pressure. Exhaled air may either pass into water chamber and bubble off, as in this two-hose unit, or pass out diver's mouthpiece (single-hose unit). "Two-stage" regulators have a chamber, where air is brought down to 110 p.s.i. or so above water pressure before release to main chamber.

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watch must be both waterproof and pressure-proof. Cost: $14-$195.

Compass. It's nice to find your way home when you come back up into weather that's turned foggy. Cost: $4-$10.

Underwater garments. How do you keep warm underwater? With special suits. These range from shorty outfits that keep your torso warm to complete suits with gloves, helmet, and boots that let you go down all year round in the coldest waters. Most divers today use "wet suits," made of neoprene foam rubber. These are close fitting and permit a limited amount of water to enter between your skin and the inner layer of neoprene. (Nitrogen bubbles in the foam act as insulation.) Dry suits, of gum rubber, are worn over heavy underwear—but these are hard to repair, vulnerable to tears, and once penetrated may admit water freely. With a wet suit, a small tear has little effect. For best results, a wet suit should fit perfectly, and this has led to the introduction of tailor-it-yourself outfits (from $28). If your body dimensions are fairly standard, you can buy a ready-made job for $50-$65. Or you can order one made to your size from one of the underwater tailors around the country, such as Central Skindivers, 160-09 Jamaica Ave., Jamaica, N.Y. (they'll send you a measurement form on request). Wet gloves ($4-$5.50) and boots ($4-$5.50) complete your ensemble.

Odds and ends. Among other items you should think of buying to complete your underwater outfit are a thermometer (to help figure in advance how long your air will last, and to spot fish-laden currents) at $2-$3; a decompression table ($4) to help you figure out your stops coming up; a gauge to check tank pressure before you go down ($10); a stringer to hold the fish you've caught ($2-$4); a flashlight ($5-$25); and, to prove to your friends that you've really been down there, a camera ($15-$4,000).

Where do you buy your underwater gear? Your best bet is a skin-diving specialty store, although department and sporting-goods stores in increasing numbers are now stocking scuba items. Among mail-order houses, Sears and Montgomery Ward carry a limited stock. Central Skindivers, previously mentioned, carries a complete line, with a 96-page catalogue available for $1.

All set? Come on in—the water's deep, cool, and mysterious. ■■

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[Continued from page 37]

—hot enough to melt bearings and ruin clutches, bands, and vanes.

When the engine isn't running, many transmissions are left without cooling. Nevertheless, some manuals say your car may be towed a few miles at "moderate speed." But to some tow drivers moderate speed means 60 m.p.h. There's another danger: Some transmissions, towed in neutral, shift themselves to Drive or even Reverse.

If you do risk front-end towing, many tow men advise, don't let the car be towed farther than two miles or over 25 m.p.h.

There are right and wrong ways to lift a car. Some tow men still hook around a bumper, bumper bracket, or any handy place. But bumpers snap. Brackets fail. The correct way is to run chains to strong parts of the frame, to special tow holes, the rear axle, or leaf springs.

Your car should always be hooked by two chains plus a strong security frame. Many tow men now use an A-frame or T-bar frame against which the bumper is drawn tight with the chains.

One of the best rigs I saw is used by Paul Longo. When the car is drawn up tight, its bumper is cradled gently in two nylon "diapers." These carry the car's weight, protect the car from chain nicks.

Another good rig is used by Lee Myles's drivers. Two big fork-lift fingers are thrust under the car and lift it by its frame.

The rear-end crane tow. In this, your rear wheels are lifted, eliminating all possibility of damage to an automatic transmission. Some cars are easier than others to hoist by the rear end, but tow men say it can almost always be done, especially with a four-by-four block for clearance.

Never steer a towed car. Most tow men secure the front wheels at center by lashing the steering wheel with rope. However, Paul Longo feels a spring-loaded "steering lock" (see photo) is safer.

Front-end tow with shaft disconnected. A few cars, including some Thunderbirds, are hard to rear-tow. Furthermore, on a fast pike it may be dangerous to turn any car around for towing. Hence your tow man may have to use a front tow, even though you have an automatic transmission.

When this is necessary, Lee Myles's tow men always disconnect the drive shaft. On most cars, removing the drive shaft requires only removing four bolts from the companion flange of the rear-end differential. Some shafts have center mounts that also must be unbolted. Others, including two-piece units, often are disconnected at the rear differential and tied under the car.

How to prevent overcharging. You have several ways to protect yourself against the tow man who tries to soak you:

- A written agreement, signed by both of you in advance, on price.
- A receipt. Some states and all toll pikes regulate rates, and an overcharge can cost a tow man his license. The New York Thruway requires tow men to show you a copy of the official rates and to give you a receipt. If you have a receipt, officials can force a gouger to return your money.
- Know the tricks. Your greatest protection is to know in advance how tow rates can be finagled. A national average cost for towing is about $8-$10 for the first three miles. But rates on many super-roads are fixed. Some are fair. On New York City parkways, for example, the rate is $4 for the first mile, plus $1 a mile. And the New York Thruway has a top day price limit of $10 for any tow. But on the nearby Connecticut Turnpike, some tow men are permitted to charge as much as $11 for the first mile, plus $1 a mile.

Now let's suppose you have a collision where the base day rate is $5 for the first mile, plus $1 a mile. You need a 16-mile tow that's going to cost $20—or so you think.

But let's say it's seven p.m. Night rates are higher (as are holiday and Sunday rates). Now your base rate has jumped to $7.50 for the first mile. If a helper comes (and tow men say he may be sent when he isn't needed), you may sometimes be charged an extra $5 (day) or $7.50 (night) an hour.

In some areas, you may also pay $20 an hour for work done by the wrecker at the scene. And if the weather is bad, or if your car is in a dangerous spot such as an intersection, there's even an extra charge for that. There are charges, too, for winching and torch-cutting. And if your car is so disabled the wheels won't turn, there may be a charge for sliding dollies under them.

Best bet: Dicker in advance. On a long haul many tow men give special rates. Instead of $70 for a 70-mile tow you may get a $40 rate—if you ask.

The police pay-off. Not all overcharging is the tow man's fault. Most towns have

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How to Get Towed Without Getting Took

police call lists, and in many, tow men say, you pay to support a racket. Here's how one man in a Midwest state broke it down for me:

"The chief drifts in and says, 'Nice wrecker you've got. Are you on our call list?'

"We know what that means. And once we get on the list we've got to *stay* on it.

"One day you have an accident. A cop calls us. We tow you in. Next day the cop drops by for his $5."

Here's how all this affects you, as told by a tow man in another state:

"We have an ordinary tow call from a corner two miles away. If you call, we'll tow for $7. But if your call comes through police, we have to charge $14. If a truck driver calls, it's a $15 charge. But if his call comes through police, it's $40."

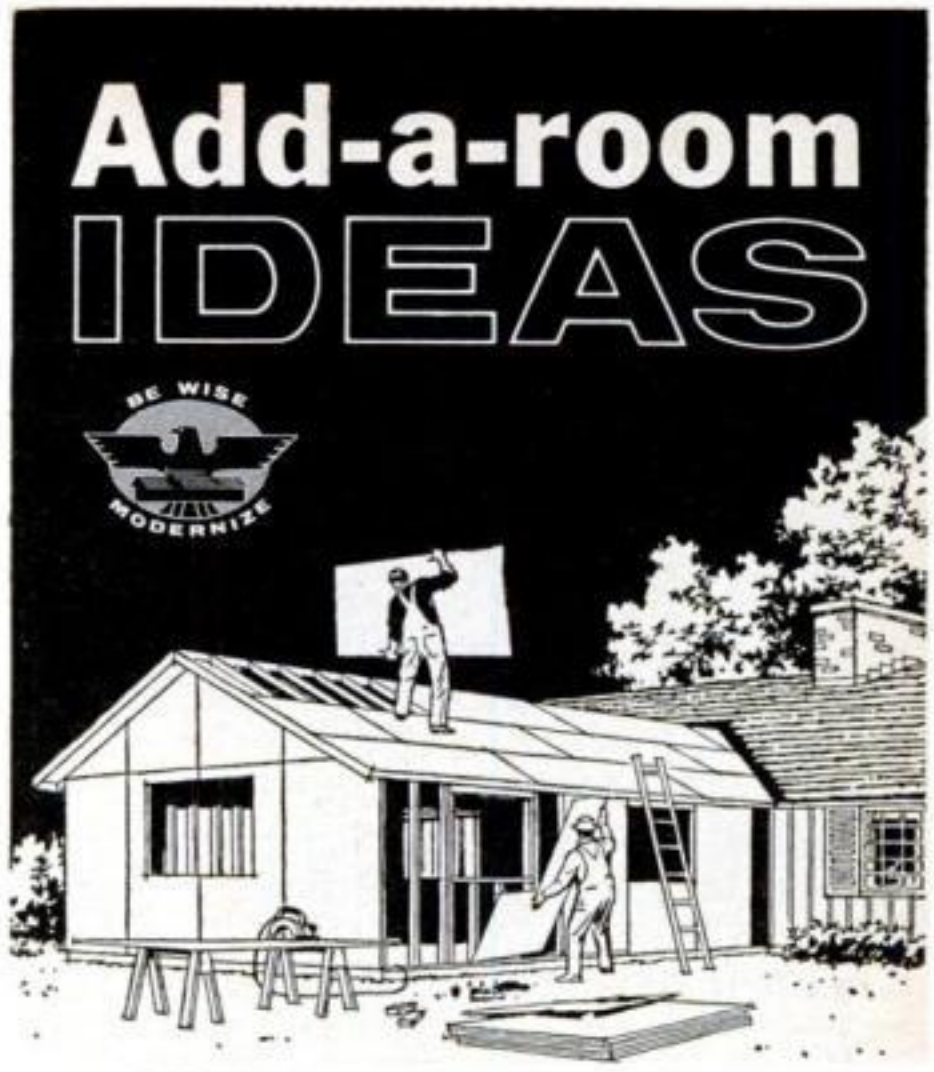
Tow men said frankly that it pays to belong to the AAA or some other auto club because you have someone to complain to. Complaints can lose a man his place on the auto-club call list. Besides that, AAA members, in most areas, get the first 10 miles of towing free.

You should know, too, that for $2.50 extra you can buy towing and emergency road-repair insurance with many standard policies. And a $12.50-yearly membership in one motor club (Allstate) includes coverage for tow and road-repair bills up to $25 —no matter who does the work. ■ ■

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[Continued from page 64]

widest possible line on corners. Avoid excessive speed, gas-happy acceleration, and coarse steering. Brake in gentle dabs on straights to keep wheels from locking.

On the road. Miles' theories on fast motoring were tested in public the next day, when we covered some 200 miles at a dizzy pace on all kinds of roads.

Britain's keep-left rule is only a slight handicap with a left-drive American car. It just means pulling out farther to see around the vehicle ahead before passing.

Starting out from a London suburb, Miles was a model of sedateness. "No point in hustling with a 30-m.p.h. limit. Don't trust side roads. Crawl up to a blind intersection if you want. It's easy to shift down with an automatic."

Out in the country, where Britain normally has no speed limit, it was a different story. First came a fast three-lane highway. "Main thing here," he began, nipping up to 80, "is smooth, steady progress."

We closed in fast on a spaced-out string of cars. The middle lane was clear. "Take 'em all at once like this," Miles continued, flooring the gas pedal for kickdown. We rocketed past. "Don't dart in and out of a procession."

Overtaking is an art, he says. Make full use of the power available, not for show-off speeding but to keep up a thrusting pace.

Formula for a fast pass is to ease out to the center of the road when you are still several lengths behind the vehicle in front. Straighten out, hold speed steady, and check the way ahead. Then you can duck back if something is coming.

If the road is clear, jab the throttle, and . . . *whoosh!* Get it over quickly.

"Now you try it," said Miles. Boldly I roared up behind a line of cars. "Too close!" warned my tutor. "Don't tailgate."

Following too close means you start the overtake at an angle. That gets you into a tight zigzag. Lay on power then and you're robbed of stability when you need it most.

I touched the brakes to widen the gap, then steered out to the middle. A truck was approaching, but the passing lane was clear. "That's better," said Miles. "The car wants to be dead straight when you're sandwiched in the center lane."

The little tricks. Miles blends logic, psychology, and acute observation to guide his moves. Never pass on a bend when a vehicle ahead blocks the view, but take advantage of the curve to look beyond it. Unless there is natural screening, a few moments' scanning of the shifting scene gives you a picture of oncoming traffic.

A lumbering truck slowed me to a crawl close to the top of a hill. As we neared the crest Miles advised: "Look under it. You can see the road ahead of him." It was empty. I sailed past, saving seconds.

Now we tailed an elderly gent in a large black sedan. "Watch his hands on the wheel," ordered Miles. "That fidgeting see-saw says 'indecision.' Give him a wide berth."

Observing the driver in front can tell you a lot. One-hand steering, or animated conversation with a passenger, calls for extra caution. So do dangling dollies and window stickers.

Make sure these types know you're coming, says Miles. If you think they'll hear, give them a blip on the horn—but only one. That's polite. Two blasts are demanding, and liable to ruffle them.

Rounding a blind curve I came up fast on a real dawdler. I hit the brakes hard to keep my distance, swung out sharply, then gave the engine full throttle. Miles lunged around on his seat beside me.

"No! No!" he scolded. "Not like that. Speed is fine, but think of your passengers' comfort and peace of mind. Use gentle and progressive braking to prevent head-bobbing as well as loss of tire grip. If you've got a manual box, avoid jerky gearshifts."

I turned off the highway onto a rural road winding across gently rolling farmland near Cambridge. The 17½-foot hardtop slewed easily through the corners. On straights, the needle hovered near 100.

"Watch those telegraph poles," commented Miles. "They show you the road layout, give warning of bends and dips."

Think-talk. Here he drilled me in the school's think-talk running commentary as a kind of oral exam. They assume that if you haven't said it you haven't seen it.

I tongue-twisted out a patter: "Surface good—road straight for half-mile—no cars—more gas—doing 75—side road to right—can see up it—nothing coming—right bend coming up—check speed—65—steer right—straighten—slow truck on hill ahead—enough room to pass before crest—mirror—nothing

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behind–pull out–kick down–doing 80–mirror–pull in–coast up over hill–speed 70 . . ."

Miles stopped me as I gasped for breath. "Not bad," he smiled. "Except you missed a bus stop, a patch of mud on the road that could be slippery, and a farm with possible stray animals."

I wove through the quiet countryside to an expressway and headed back to London. "Here with 300 horsepower you stay in the fast lane," Miles remarked, "but with one eye on the mirror. Move over if someone shoots up behind, then come back out again when he passes, giving a turn signal each time you change lanes. It's much safer than looping in and out. And it won't happen often."

Curriculum: speed. The High-Performance Course was started 18 months ago, and since then has had over 300 students. Many are people who already own a fast car. But a lot are ordinary enthusiastic drivers who take lessons in the same way they might see a golf pro to improve their game. Several Americans are among them. A cook on the liner United States squeezed in a driving period each time the ship docked at Southampton.

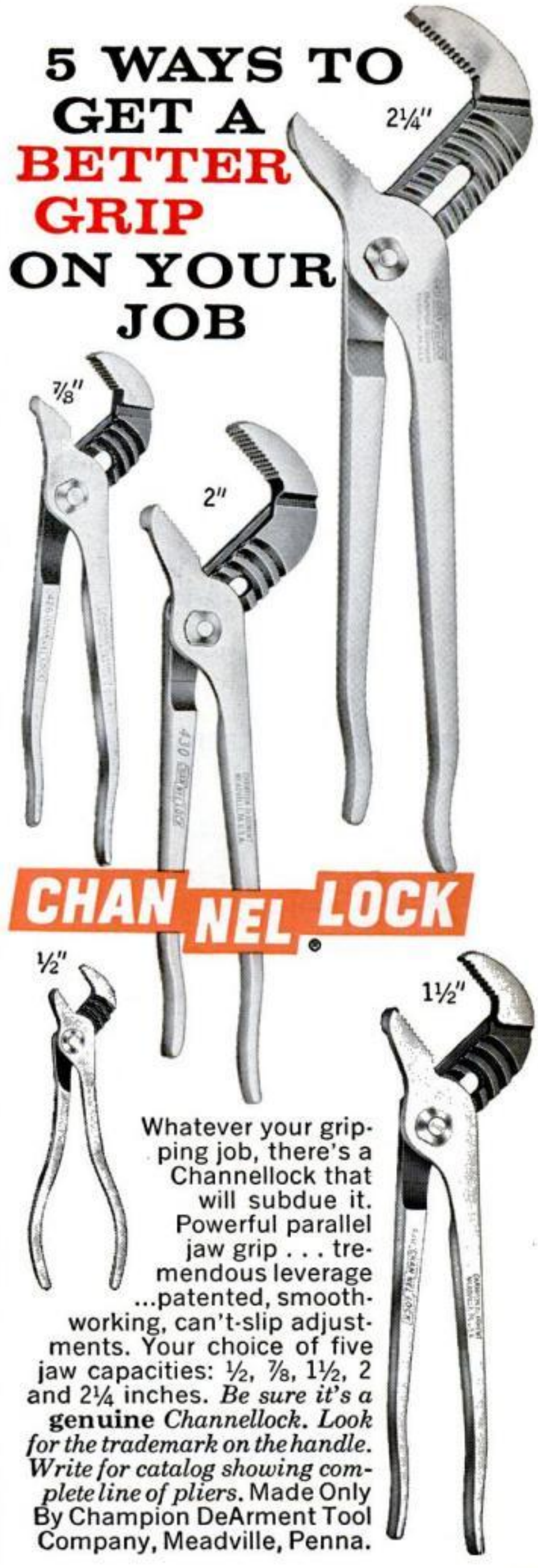
Applicants are given a one-hour check test to see if they come up to precourse standards. Drivers with little potential or sluggish reactions are rejected.

The course runs 15 hours. The first day, you spend six hours at Brands Hatch, as I did. For teaching sessions, usually with four students and cars at a time, the school has the track to itself.

Ten cars of varying hotness make up the school fleet. They range from a Jaguar XK-E and an Aston-Martin DB4 to an Austin Mini-Cooper and a pepped-up front-drive Saab. Pairs of cars take different directions around the circuit, presenting student drivers with opposing traffic.

The rest of the time is normally divided into three-hour periods spread over several days to allow new ideas to sink in. Altogether you cover about 500 miles.

Fee for the basic course equals $130, which includes the use of school cars for all instruction. Successful finishers are awarded a diploma, car badge, and membership in the High-Performance Club, claimed to be the most exclusive driving organization in Britain. So far, 50 have flunked. ■ ■



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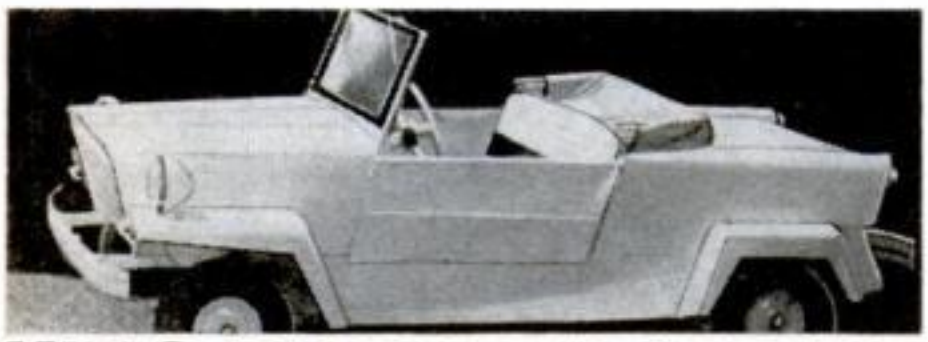
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How Robot Rainmakers Pamper Your Lawn

[Continued from page 105]

Toro has a porous ceramic cup buried in the ground. As the soil dries, moisture seeps out through its walls, creating a partial vacuum inside. The drier the soil, the higher the vacuum.

Copper tubing connects the cup (or hydrostat) to a diaphragm in the controller. If the vacuum calls for water when the time for sprinkling comes around, the diaphragm trips a clutch. Solenoid valves open in sequence, applying water pressure through copper tubing to open and close diaphragm valves in the zone lines.

Moist O'Matic sprinklers are designed for low precipitation—¼" per hour—a gentle application for which several advantages are claimed. Installation costs less because smaller piping and valves are used. Water is not wasted because run-off is avoided. Fewer heads are needed; two Toro sprinklers can cover 2,000 square feet with a modest flow of six gallons per minute.

Moist O'Matic heads should delight the gadget lover. The heavy-duty type has a complex gearbox, powered by a turbine. Even more puzzling, though simpler at first glance, is a pop-up unit made for home systems. Its tiny turbine, without reduction gears or rotating shaft between it and the nozzle, turns the nozzle at a sedate rate—and in the opposite direction.

Getting out the bugs. Controls of all these devices had to be designed to fail safe should the electricity go off. To avoid damaging water hammer, automatic valves had to be taught to close gently. Although virgin polyethylene pipe sustains freezing, fittings and heads do not, so manual drains or automatic check valves were needed.

There's more to installation than burying pipe and sprinkler heads. Plans should be made to scale, with every shrub, tree, and walk in the picture. Layouts must take into account available gallonage, such requirements as watering trees from at least two sides, and low-spraying heads for flowers.

There's a sprinkler in your future. In a few years, predicts Toro's president, David M. Lilly, an automatic system will cost no more than an air conditioner, and automated watering will burgeon into a $30,000,000 industry.

It will also grow more and better grass. "And that," adds the Toro executive with smiling frankness, "means more power-mower sales." ■■

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New Epoxy Stops Leaks

[Continued from page 109]

boring marine worms or boat-wreckers like toredos drill through the tough layer.

An admitted maverick, the new water-cure epoxy has a number of peculiarities. It must be applied to a wet surface (it won't bond properly on most dry surfaces). Moreover, "curing" doesn't necessarily imply rocklike hardness. Some formulators, claiming better anti-abrasive results from a more flexible coating, compound their products to cure to a rubbery consistency.

Even though chemically unaffected by moisture, "wonderful goo" generally hardens faster above water (as applied to a rain gutter) than underwater (as on a piling). Curing time is also affected by how thick a layer of goo you apply. The thicker the layer, the faster the cure, especially underwater. Reason: Much of the self-generated curing heat is dissipated from a thin coating by the surrounding water. The same formula applied in a mass (say, when you're plugging a leak in a boat bottom) may harden in minutes, even in cold water.

How you use it. Application, whether in water or out, is a three-step process:

- *Cleaning the surface.* For good bonding, all surfaces must be scrupulously clean. On a water pipe, this means completely removing all rust, scale, sea growths, or paint. A wire brush and scraper will do the job here.
- *Mixing the epoxy.* The resin and its agent should be kneaded with a gloved hand or trowel until thoroughly mixed. This will take about 10 minutes; don't try to hurry it. Since the resin and catalyst are usually different colors, an improper mix will show up in telltale streaks.
- *Applying the coating.* Although various application techniques have been tried, the best so far is nothing more than a wetted rubber glove, with the goo "painted" on by hand. As long as you keep the glove wet, the epoxy goes on smoothly and evenly.

For hard-to-get-at places, you can also use a regular calking gun. The gun forces the sealer deep into cracks and small holes where hand application might miss.

Two application cautions are in order. The presence of oil or distilled water prevents proper curing and bonding. Once cured, however, the epoxy is impervious to both. Also, prolonged exposure of bare hands to the mix can cause skin irritation, so it's wise to wear gloves. ■■



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The Little Engine That Almost Did

[Continued from page 39]

This meant less push but better mileage—and fewer pit stops—for the Fords.

It would be abusing the truth to say that Ford's Indianapolis engine was a scaled-down 289-inch Fairlane-Galaxie engine. It was not.

The cylinder block and heads were aluminum, not iron. Rocker arms and connecting rods were beefed up. Special pumps lubricated the machinery. The engine had a "dry" sump so that connecting rods and cranks would not flail the oil into a froth and frustrate the pumps.

The engine front cover and pan were made of magnesium for lightness. Piston heads were domed to raise compression ratio from 11:1 to 12.5:1. The ignition system was a breakerless distributor with transistorized amplifier and conventional coil.

That seems like a lot of trouble to go to for power, especially when 427-inch Galaxie engines have been winning stock-car races with monotonous regularity.

But there was good reason: Engines for the Indianapolis race are limited to 256 cubic inches, and out of that the Offies pull 400 horsepower. More important, at steeply banked tracks like those at Daytona Beach, site of NASCAR's "Daytona 500," a driver simply puts his accelerator foot in the carburetor and sits there.

At Indianapolis, by contrast, a car must go through four flattish turns for each circuit of the 2½-mile track. That means acceleration from about 130 m.p.h. in the "corners" to 180 m.p.h. on the straightaways. And that means an engine like Ford's little V-8 must bounce back and forth between 6,000 and 7,800 r.p.m.

Well, everything worked out fine. Colin Chapman, builder of England's famed Lotus car, made three chassis and balanced them for installation of the engine in the rear. Each chassis plus engine was hundreds of pounds lighter than the Offy competition. Putting the engine in the rear eliminated the drive shaft and its inevitable vibration. The light weight saved tires.

No, the Lotus Fords didn't win. One cracked up in qualifying. One, driven by Jimmy Clark, a Scot, came in an easy second. The third, piloted by California's veteran Dan Gurney, finished seventh. The winner, in an Offy: Parnelli Jones.

But next year? ■■

[*Continued from page 134*]

bugs and insects. When you capture them in the field, you'll need a plastic container to hold them. Bringing 'em back alive is difficult with butterflies. They can injure their wings in any kind of container.

You can also collect your insect models by gathering cocoons any time after August. Just break off twigs with cocoons attached and you can take pictures at your leisure. If you keep the cocoons warm (room temperature), the butterflies or moths will emerge earlier than usual.

When a moth or butterfly emerges from a cocoon, the wings must dry before the insect can fly. This may take several minutes or several hours and gives you time to get set up. When the wings have never been used, the colors are at their best.

You'll find that a butterfly or moth deposits its eggs on whatever plant the caterpillar eats. The Monarch butterfly, for example, lays its eggs on milkweed plants. When the caterpillar hatches, he can start eating–he's right at the dinner table.

I made a cage of window screening for photographing insects. It's about 2′ wide, 1½′ deep, and 2′ high. The top and one side open, and cardboard cut to size slides into place for backgrounds.

The slow freeze. Insects are fragile, and you have to handle them carefully. I drop them in small plastic containers and put them in the refrigerator–not the freezer–for about 30 minutes.

The low temperature makes them inactive. While they're quiet, I set them on foliage taken from their natural environment. When they warm up, they grasp the leaf or the flower and assume natural poses. That's the beauty of temperature control. Depending on the size of the insect, it takes 10 to 20 minutes for it to become really active again. In that period, you can take many pictures.

As a rule, I use tweezers to move my insect models. Handling one by hand can soon disarrange the scales of a butterfly or injure a leg.

It's often a good idea to place a small insect on some object to show comparative size–the head of a tack, for example.

By selective focus, you can create an unobtrusive background. The flower or insect is focused sharply, and the rest is thrown out of focus. For best results, keep your backgrounds simple. ■ ■

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[Continued from page 57]

announces: "Ready to lower the erector."

T minus 35:51. Test Conductor: "Starting to lower the erector."

T minus 33:25. First visible movement of the 140-foot-high erector. As if falling in ultraslow motion, it goes on and on leaning over, unsheathing the missile, gleaming in the sun and clearly visible for the first time, still attached to its umbilical tower. At T minus 29, the top of the erector finally touches the concrete of the pad.

T minus 20. It is now 1:40 p.m. The built-in hold has begun, and a few minor snags are being cleared up.

2:10 p.m. Unexpectedly sprung from my prison, I've just come back from a little walk. Major Hutchison had invited me to take a look at the bird from outside the blockhouse.

We walked part way around the dome and stopped near a sign that said: "Gas masks required beyond this point." There stood the Titan II on its raised concrete launch pad, silver and white against the sky.

I asked the major, a lanky Southerner, how he felt about working with the propellants used in the Titan II. "They're not all that dangerous to handle, once you know how," he said.

They're called storable propellants because they need slight refrigeration compared with the LOX (liquid oxygen) used in the Titan I. The fuel is a mixture of two kinds of hydrazine and the oxidizer is nitrogen tetroxide. These fluids are "hypergolic" —they ignite on contact with each other. The hydrazine fumes are highly toxic.

"You never get tired of watching these birds go up," the Major said. "Trouble is, I've never seen one of my own birds lift off from outside the blockhouse. The periscope's not bad, but the perspective just isn't the same as an eyeball view."

2:18 p.m. Back inside the blockhouse, the order to begin clearing the pad has gone out, although the hold won't end for half an hour. The blockhouse is quieter now, no longer casual.

2:34. The countdown announcer says sternly: "Seal the blockhouse. Maintain silence. No smoking in the blockhouse."

2:37. "The blockhouse is sealed. Vents are closed."

2:40. "T minus 20 minutes—mark! T minus 20 minutes and counting."

Silence for a minute or two, as switching sequences are carried out. Now the stations begin reporting their initials, followed by sets of numbers—the critical values of each of the systems.

T minus 13. Silence falls again. Range checks and "RF compatibility checks" are under way, to make sure that all tracking stations are working, and that there is no interference between the radar beacons and telemetry transmitters in the missile.

"T minus 10—mark! T minus 10."

The Test Conductor asks: "Do you have launch enable?"

A voice replies, "Affirmative."

T minus 8. Test Conductor: "Is MISTRAM still compatible?" (This refers to one of the tracking systems.)

"Affirmative."

T minus 6:12. "All personnel switch to Channel 2" (the Test Conductor's channel).

Now comes the final status check of all systems.

The Test Conductor: "GE tracking."

"Go."

"Propulsion."

"Go."

"Electronics."

"Go."

"Missile safety."

"Go."

"Instrumentation."

"Go."

"Mechanical."

"Go."

"Pad safety."

"Go."

"Power."

"Go."

"Guidance."

"Go."

"Supervisor Range Operations."

"SRO is go."

"Ballistic Systems Division."

"BSD is go."

"All systems are go," says the Test Conductor.

T minus five. It's the moment of decision. The men at the committee table look at each other silently. Major Blackburn, the Test Conductor, turns around, smiling broadly. Major Hutchison smiles back, reaches across the table and shakes his hand.

Telemetry recorders are now turned on. At T minus 3, Major Hutchison takes up a position at one of the periscopes. Nearly all the men in the blockhouse have turned from

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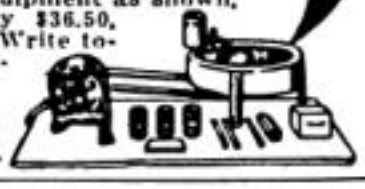
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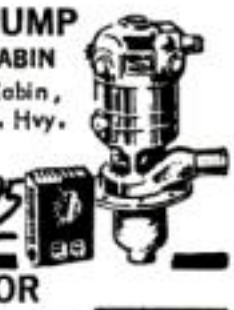


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their consoles and are leaning forward, looking up at the TV monitors.

T minus 2:07. The water that protects the flame deflectors under the missile comes on. Although it's a spray, squirting through quarter-inch holes in the flame buckets, it gushes from beneath the pad as if from a burst dam.

"T minus one—mark!"

T minus 36 seconds. "Final clear to launch."

T minus 30 seconds. Automatic sequencing equipment is now controlling the final seconds of the countdown.

T minus 10 seconds. The announcer starts his final chant: "Ten—nine—eight—seven—six—five—four—three—two—one . . ."

The Titan lifts easily from the pad and starts up—silently, it seems, since the blockhouse walls are so thick. There's a muffled thud and the floor shakes slightly. I feel a sense of anticlimax, but then, through a ventilation grille in the floor, I hear the cheers of the pad crew below, watching their own TV monitors.

The missile rapidly disappears on the TV screens. Major Hutchison is gritting his teeth at the periscope, trying to see the second stage ignite.

Major Catalano is standing in the middle of the blockhouse, relaying information coming through his earphones: "Going good . . . going good . . . going good . . . it's on the line . . . it's on the line . . . going good . . . it's on the line, on time . . . going good . . ."

He winds it up at T plus 3:19 with: "Missile is going good; we will not have any marks." (There's been a temporary failure in the communication link from downrange, and the results of the shot are not immediately known.) A few minutes later we learn that the second-stage rocket engine cut off too soon, and the missile fell short of its intended range.

The flight is considered a partial success. The countdown, however, was perfect. Lift-off took place within a fraction of a second of the scheduled time.

On the way out, Major Catalano takes me around the side of the blockhouse and points to the pad. The area right around the hold-down clamps is blackened, but the rest of the pad looks untouched.

"All it needs is a paint job," says Major Catalano. "We can put another bird on that stand in three days." ■■

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Does Your Boat's Tail Drag?

[Continued from page 123]

for as little as $8 or $9 a pair and are an inexpensive way to improve a boat that's chronically tail-heavy, like a fishing boat that's steered from the stern.

Fancier trim tabs can be adjusted by remote controls any time you wish. The tabs are moved up and down by push rods or cables that work much like steering controls. In deluxe versions, the tabs are operated electrically or hydraulically. One type uses CO_2 gas to control the tabs automatically. Prices for the simplest remote-control types start at about $40.

Tabs solve many problems. One big headache they overcome is the poor visibility that goes along with "stern squat." If you've ever tried to navigate around a crowded harbor with your bow pointing skyward, you know what a hazard this can be. Trim tabs keep your boat flatter at slow speeds so you can see where you're going.

In rough water, wind and waves force the bow up and often knock a boat off plane. Here, too, trim tabs can help keep the bow down.

They'll also help compensate for that "hook" that often develops in a hull bottom with age or after a boat has been stored on a trailer too long. The motor drives the boat up onto the top of the water, but because of the hook there isn't enough planing surface to keep it there. The hull plops back down, and the whole process is repeated over and over in a series of rhythmic jumps and bounces. Trim tabs add the needed extra planing area to eliminate this porpoising.

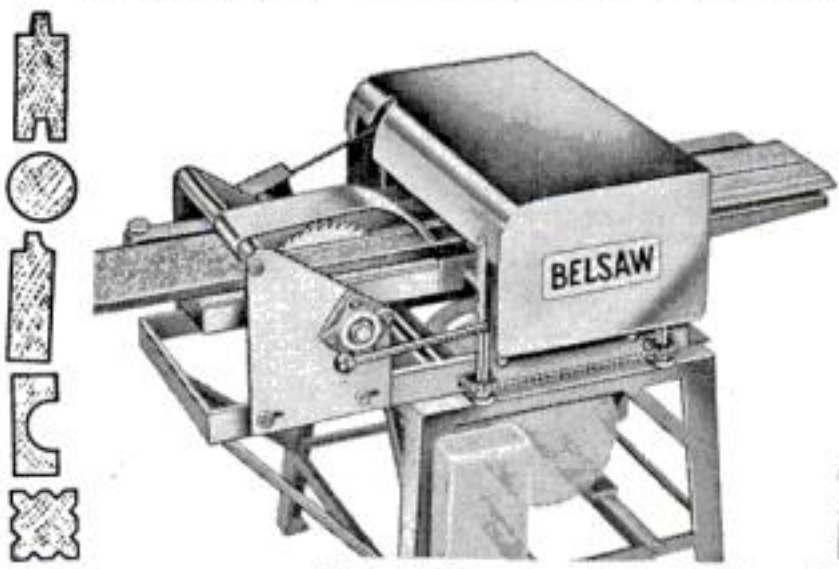
Difficult steering due to chronic yawing is another situation in which trim tabs shine. With powerful motors, prop torque wants to spin the boat in the direction opposite to rotation. This often causes the hull to ride higher in the water on one side than the other, putting the boat into a perpetual bank and making it wander off in an arc.

Since trim tabs can be adjusted individually, you can tilt the one on the low side down farther, forcing that side to ride higher. With the boat leveled, it stays on a straight course.

Trim tabs can also save you money on fuel and promote longer engine life by helping to maintain the most efficient planing attitude. In a boat that's not properly trimmed, the engine labors, wasting fuel and straining its innards. ■■

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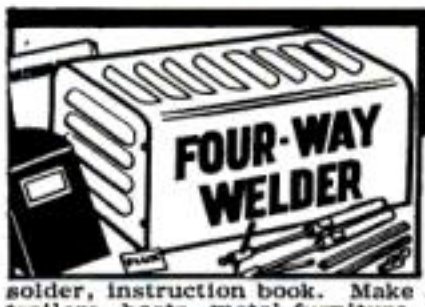
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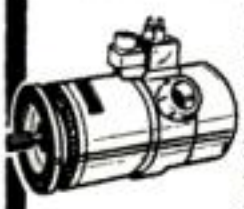
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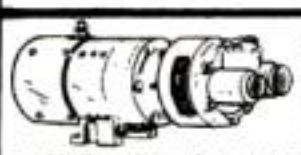
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The Tools You Need for Pipe Jobs

[Continued from page 100]

easiest to use for building structures of pipe.

In addition to the proper size die, you'll need a round bushing to fit the pipe you're using. This is held in the stock along with the die and helps to guide the die onto the pipe.

Most die-holding stocks have two handles, one on each side. There's also a single-handle type that works by ratchet action—you give it a short swing, then back it up to take another swing. It's designed for easier plumbing work in tight places, but it's more expensive and isn't generally needed in structural work.

If you need only one or two dies for occasional work, there's a handy type sold by Sears, Roebuck that requires no die holder at all. Each die comes with a guiding collar that can be turned onto the pipe with a chain or stillson wrench. This saves you the cost of a stock. The dies are available, however, only in ½" and ¾" sizes.

The three important rules for cutting a thread are: Get the die on straight to start with, use plenty of cutting oil, and make the cut in easy stages. Take a partial turn on the die, then back it up and clear out the chips by rapping the stock handles before taking another turn. Never just "screw" the die onto the pipe. It will jam and produce distorted threads. Keep applying fresh cutting oil as you turn the die on.

Two types of wrenches. The old-time stillson wrench is still the standard tool for pipe work, although there's a newer chain type that works on the same principle as a chain vise. The stillson may have a more familiar feel, but you'll probably need two sizes—10" and 14"—to handle a full range of pipe. The chain wrench can usually be adjusted to fit a somewhat wider variety of pipe sizes.

Stillsons come in two types—the conventional straight-head kind and one with an angled head for easier working in cramped quarters. Where extra leverage is needed, a length of pipe can be slipped over the handle to extend it. Quick, sharp hammer taps are permissible to free a frozen joint provided they aren't too heavy. Never sledge-hammer a handle—it may snap in two, dangerously.

You'll find a good stillson will bite better if you brush its teeth occasionally. This will remove metal chips that build up in the teeth and blunt them. ■■

[*Continued from page 78*]

out of the egg, they have been carried into waters that are too deep for them. They starve to death before they can reach the food on the bottom.

Then the fishermen know a lean season, but not the sea. All marine farming goes on just under the surface where sunlight and air are available. What's surplus on the farm sinks. What's not eaten in sinking is picked up and carried from consumer to consumer by a current. If too long a delay in marketing the produce makes it deteriorate into rubbish, no matter. Nature wastes nothing. Eventually the rubbish reaches an area of the ocean that has currents to carry it back up for reprocessing.

Chemical examination of very deep currents reveals that Nature is not only a thrifty but a diligent housewife. The ocean bed, in addition to continually being washed, is made up every 1,000 years or so. The currents turn the ocean over completely in that time, moving the bottom sheets to the top for an airing, the top sheets to the bottom. The currents do all that in addition to making the sea a community whose producers produce selflessly, for each other.

THE best known current of them all, of course, is still the Gulf Stream—which first came to public attention soon after 1770, when it was charted by none other than the amazing Benjamin Franklin, then Postmaster General of the Northern American colonies.

That amazing man had found out about the Gulf Stream by questioning Nantucket whalers to learn why their slower vessels were regularly shaving two weeks off the time it took the mail packets to cross from England. The lordly masters of the king's ships were, to use Franklin's own words and spelling, "too wise to be councelled by simple American fishermen," and had neglected to notice that even in the middle of the ocean they were nevertheless toiling upstream.

Franklin was still trying to learn more about the Gulf Stream on the last voyage he ever made, after he retired as U.S. Ambassador to France. He was 79 then, weakened by numerous ailments, in such torture from a stone in his bladder that he had to be carried to his ship from Paris in one of Marie Antoinette's litters. He knew

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he was going to die, but he busied himself during the crossing measuring the temperature of the stream 100 feet under its surface, rigging up for the purpose a gadget whose basic principle is still used in oceanography today, a cask with a valve at each end that operates by itself under pressure of the water.

Some of the equipment needed today is, of course, a bit more involved. Today's oceanographers have a technology that is as remarkable in its way as that developed for the space program. To explore the behavior of sound waves, they have the good ship Floating Instrument Panel (FLIP). Built with the U.S. Navy's help at a cost of $500,000 for use by the Scripps Institute of Oceanography in California, FLIP actually flips up to stand on end in the sea when its stern is flooded [see "The Ship That's Built to Sink," PS, Dec. '62]. Since it is 350 feet long, it stretches far enough below the surface to keep the scientists on top and their instruments nearly motionless even in the 30-foot waves of the great Pacific storms.

For other purposes, there are ships with glass picture windows in their keels, so-called "wet submarines" (actually, underwater scooters that scuba divers can ride around on or be towed by), and dry submarines. One is operated by pedals to keep the air inside breathable for a prolonged period. Another has skis for taxiing around on the bottom. A third, capable of working two miles down—a depth that would crush any Navy submarine—has long arms to reach out for objects and haul them on board.

ONE merciless, 55-below-zero night in Greenland, I watched an arm of the Gulf Stream come into Denmark Strait. The train of water I saw had left Florida two months and more before, had picked up the famous climate in passing and carried it through 5,000 miles of heaving, wind-driven ocean. Now it was delivering it with an enormous, soundless rush.

The warm current gives to Angmagssalik, a huddle of souls on the shore of the Strait, a reputation among travelers as "The Riviera of the Arctic." But for the fish it means life itself. They congregrate and thrive as numerously in the bitter Arctic as in temperate waters.

Denmark Strait is a terminal. Here the train discharges heat, picks up a cargo of surplus raw and finished products, and turns around. Heavy with new freight and a new climate, it sinks onto a track on a lower level that takes it south under the track on which it had come north.

The mechanical forces that propel the currents over great distances are extremely complex. They range from the rotation of the earth itself to the wind-created "hills" (some say the ocean at Bermuda stands a yard higher than the ocean at Massachusetts) and include differences in salinity and temperature.

The most important force is believed to be the wind, particularly the great trade winds that blow so steadily over equatorial waters, and those that circle around the North and South Poles. The greatest oceanographic fleet ever assembled—40 vessels, representing 20 different nations—is sailing the Indian Ocean this year and next. One of the major missions of its exploration is to better determine how winds and other forces set up particular patterns of circulation. The Indian Ocean is the only ocean in the world whose main river is known to reverse its flow, usually twice a year, with the onset of the northeast and southwest monsoon seasons.

As men all around the world peer over the shoulders of the oceanographers exploring these ceaseless comings and goings, they expect practical benefits—and are likely to get them sooner than from space exploration. They hope, for instance, to increase the harvest of fish for the undernourished lands that border the Indian Ocean. But, in the long run, the greatest practical benefit of the ocean currents to man may be what they demonstrate of the profound concern for life that governs even the deep.

Presumably, the currents were there before the fish, and the fish adapted their life processes to them in the way that has come to be called evolution. But if the members of an orchestra left their instruments out in a storm, they'd be very startled to hear the strings and resonance chambers adapt mindlessly to the mindless passing of the winds by chiming in with each other to play a great, complex symphony. At least one assumption would be hard to resist: The symphony being played by the instruments had been composed by a Mind, not by mere adaptation. ■■

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SUPERSENSITIVE transistor treasure finders. $19.95 up. Kits available. Free catalog. Rellko, Box 10563, Houston 18, Texas.

FUN & Profit finding buried treasure, relics with Transistor M-Scope. Booklet, interesting customer comments Free! Terms. Fisher Research, Dept. DX, Palo Alto, California.

FINEST transistor coin, metal locators. $34.95 up. IGWTS, Williamsburg, New Mexico.

GUARANTEED Metal, Treasure And Water Locator Only $3.00. Robbins-1, 57 Scott, San Francisco 17, Calif.

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CLASSIFIED OPPORTUNITIES

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[Continued from page 83]

and the holes it is supposed to go through gets complicated. With about a million tiny holes in the screen, it is a tough job to keep everything straight. And the more the beam must bend, the rougher it is to keep colors clear at the edges.

That's why today's sets are still so bulky. It'll take 90-degree and rectangular tubes to improve the situation. One report claims that Motorola may have just such a tube: a big (23 inch), 92-degree job that is six inches shorter than the standard color tube. Prices, the report says, will probably start at $650.

Meanwhile, announcements of new kinds of tubes that could lower prices or offer other advantages come thick and fast. So far, though, none is in production. Here are some of the most promising:

Paramount Picture's Chromatron. This tube, say Paramount officials, will be not only cheaper, but brighter as well. Big limitation on brightness of the shadow-mask tube is that not enough electrons reach the tube face to light it up brightly. The Chromatron gets around this by replacing the shadow mask with a fine structure of wires that let through many more electrons. In front of the wires is a series of thin vertical strips of color-producing phosphors, which glow red, green, or blue when struck by the beam. The wires are charged so that they deflect the beam passing between them. If they're charged one way, for example, the beam will strike only the red phosphor strip and that part of the screen will glow red. Another charge, and only the blue phosphor would be hit, and so on. I saw the Chromatron in operation at Paramount's New York laboratories, and it is startlingly brighter than conventional sets. Nevertheless, no U.S. manufacturer has signed up to make it. One engineer told me his firm had decided against it on the grounds that there might be substantial problems in getting the tube into production. Sony, a large Japanese electronics firm, has taken out a license to make Chromatrons, and is now setting up a pilot production line.

The Sylvania-Thorn tube. This prototype, built in England, also has lines of colored phosphor across the face. The beam from a single gun wiggles back and forth across the lines, lighting them in proper sequence.

The "Sunflower" system. Designed by Harries Electronics Corp., of Bermuda, it uses three small picture tubes—one for each color—and projects their images onto a screen to blend and form the complete picture. Trouble is that the three tubes "shoot" from slightly different angles, and the registration of the three-color image is not perfect. The "sunflower," a specially shaped lens, is designed to correct this.

The "apple" tube. Introduced by Philco more than five years ago, the apple tube uses a small light-generating element and lenses to distribute the various flashes to the right parts of the screen. This was followed, naturally, by the "banana" tube built by Mullard Research Laboratories in England. The tube forms the entire picture on four hair-thin strips of colored phosphor, then uses a spinning prism to project them onto a screen at the proper places.

The Goodman tube. Designed by New York University scientist David Goodman, this tube uses fine lines of color-producing phosphor, as does the Chromatron. The trick here is in the indexing, the method used to keep track of where the beam is at any given moment. Between each set of three color bands, the Goodman tube has a fine metallic strip deposited on the tube face. When the beam from the electron gun hits the metal strip, it sends off a shower of low-powered X rays. A detector in the tube senses the X rays and, in effect, notifies the other circuits that the beam has just crossed a metallic strip and will cross the three color strips in rapid succession next. These circuits then turn the beam intensity up for the red, blue, or green strips in any combination to give the proper color.

Whether any of these approaches—or perhaps some different one—will ever replace the shadow-mask tube remains to be seen. But most experts agree that a sharp reduction in prices through a major advance seems unlikely in the near future. In the meantime, though, you may be able to do much better than you think. Discounting is the rule already in some areas; it is certain to become widespread as the color boom really gets under way. Five-hundred-dollar models are available at a 20-percent discount in some areas.

With lower prices and rapidly increasing color programing, color TV is clearly ready to go into orbit. As General Sarnoff said, "We are approaching escape velocity. This is our year." ■■

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I'M SICK AND TIRED OF WAITING!



1. EVERYTHING COMES TO HIM WHO WAITS? THAT'S A LAUGH. I WAITED FOR THE BREAK. WAITED 'TIL I WAS SICK OF IT. HOW LONG CAN A GUY WITH A WIFE AND 3 KIDS GO ON DREAMING?

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4. THAT SETTLED IT! I DECIDED TO FIND OUT WHAT I.C.S. WAS ALL ABOUT. AFTER ALL, WHAT DID I HAVE TO LOSE?



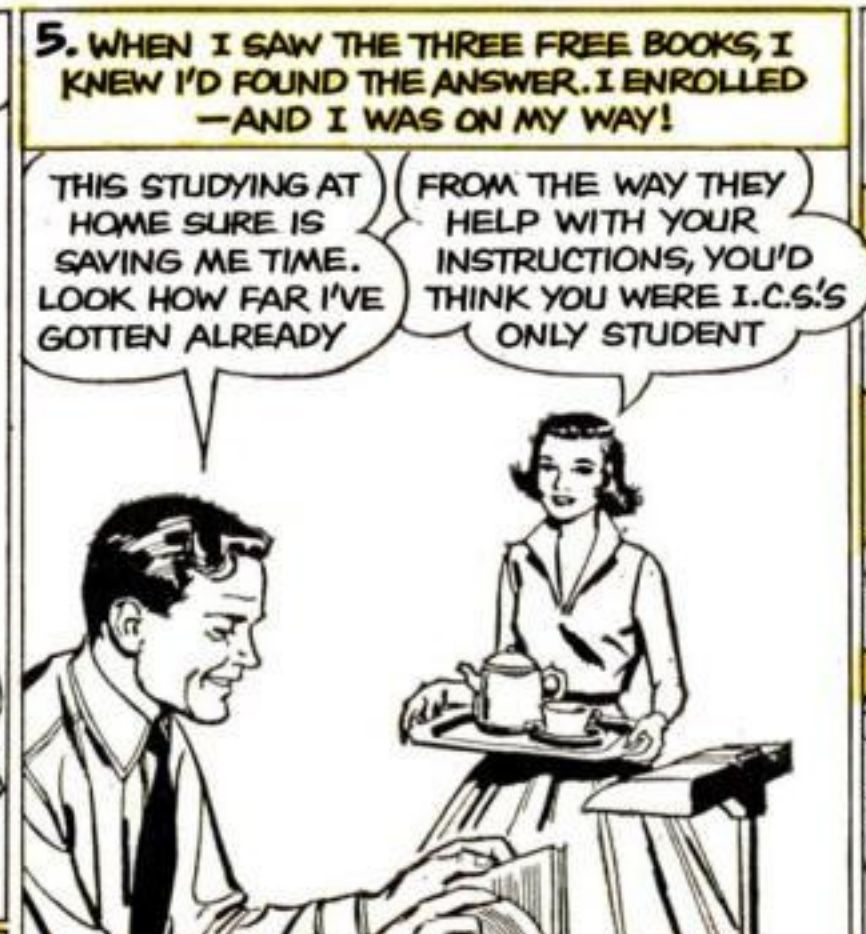
2. MY WIFE AND I THOUGHT ABOUT IT, TALKED ABOUT IT, WORRIED ABOUT IT. WE WERE STUMPED. WE THOUGHT WE HIT A DEAD END



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5. WHEN I SAW THE THREE FREE BOOKS, I KNEW I'D FOUND THE ANSWER. I ENROLLED —AND I WAS ON MY WAY!



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